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Ceanothus Griseus 'Santa Ana'

A New Cultivar

PERCY C. EVERETT

When one searches the range of horticultural literature for information concerning the uses, values, results or any phase of garden culture in reference to the native plants of California, one cannot help being made aware of the popularity of the genus *Ceanothus*. Although the many species of the genus are not entirely confined to California, the greatest number find their distribution within this state.

The cultural history of the genus, as a whole, has been rather discouraging to most gardeners. Through the efforts of several horticulturists and botanists, particularly Maunsell Van Rensselaer, Director of the Saratoga Horticultural Foundation, Howard McMinn, Professor Emeritus of Mills College, L. L. Edmunds, nurseryman, of Danville, California, and Theodore Payne, native plant specialist, Los Angeles, and through the experimental work being carried on by the Santa Barbara Botanic Garden, the Rancho Santa Ana Botanic Garden, and other institutions, the cultural vagaries of the various species are becoming better known.

Undoubtedly its popularity is due mainly to the magnificent profusion of flowers produced by many of the species, and because of this popularity there has been a greater search for more suitable types for our gardens. The many species comprising the genus *Ceanothus* are a rather promiscuous lot, and when they are brought together in large collections, many interesting hybrids arise through the seedling populations. Further, because of the increased interest among gardeners, the wild populations have been more critically searched for outstanding types; through such investigations, both seeds and cuttings have been procured. Notable among the species have been the forms found among *C. griseus* and its variety *horizontalis* and *C. thyrsiflorus*. Cultural history seems to have proved them better able to withstand most gardening practices, and they are far more attractive on a year round basis.

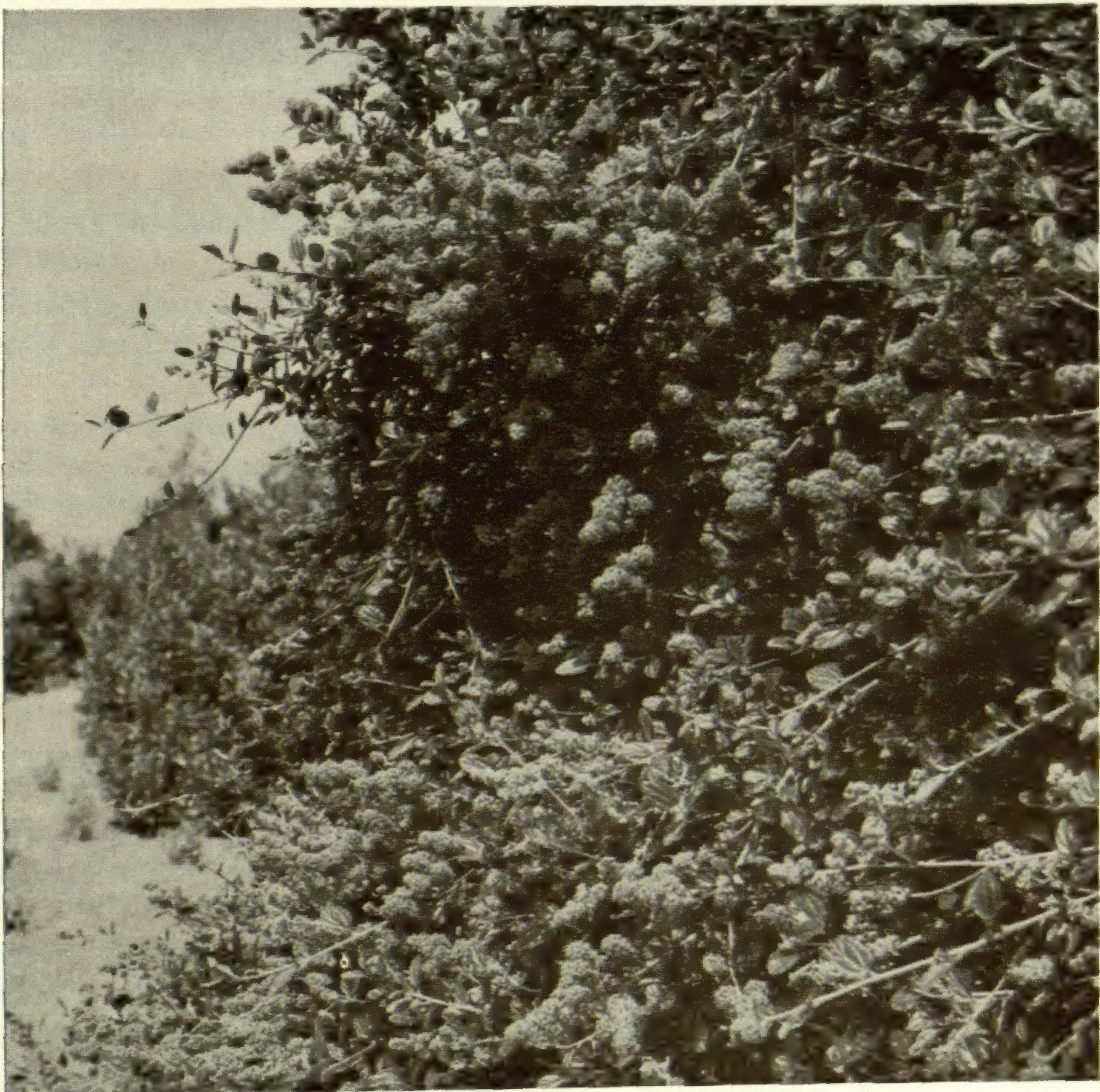
During the past fifteen years quite a number of horticultural forms or cultivars have been introduced to horticulture. Some have been particularly noteworthy, others were not much more than a passing fancy. *Ceanothus griseus* 'Louis Edmunds,' named by Maunsell Van Rensselaer in honor of this famous native plantsman of Danville, Calif. who introduced it to the trade, is one of the outstanding selections of this group so far introduced into horticulture. So it is with some hesitancy that we propose another selected cultivar for the same group. However, because of the enthusiasm of several nurserymen who have introduced it to the trade, and because of its outstanding popularity at this Botanic Garden and its good behavior as a garden subject, we feel it is necessary to publish this form in conformity with the rules as set down by the International Horticultural Congress. This is particularly necessary since the name *Ceanothus griseus* 'Santa Ana' has already been established by usage in the nursery trade.

On July 22, 1949, Mr. Edmunds collected seed from a prostrate plant with small leaves, located 1¼ miles south of Pt. Arena, along the coast of Mendocino County, California. He determined it to be *C. griseus* var. *horizontalis* McMinn. However, since the distribution of *C. griseus* var. *horizontalis* is given only for the Yankee Point area, Monterey County, and the numerous offspring from this seed collection are so variable in growth habit, on the whole more closely resembling *C. griseus*, we consider *C. griseus* 'Santa Ana' to be one of the many variable forms of the species.

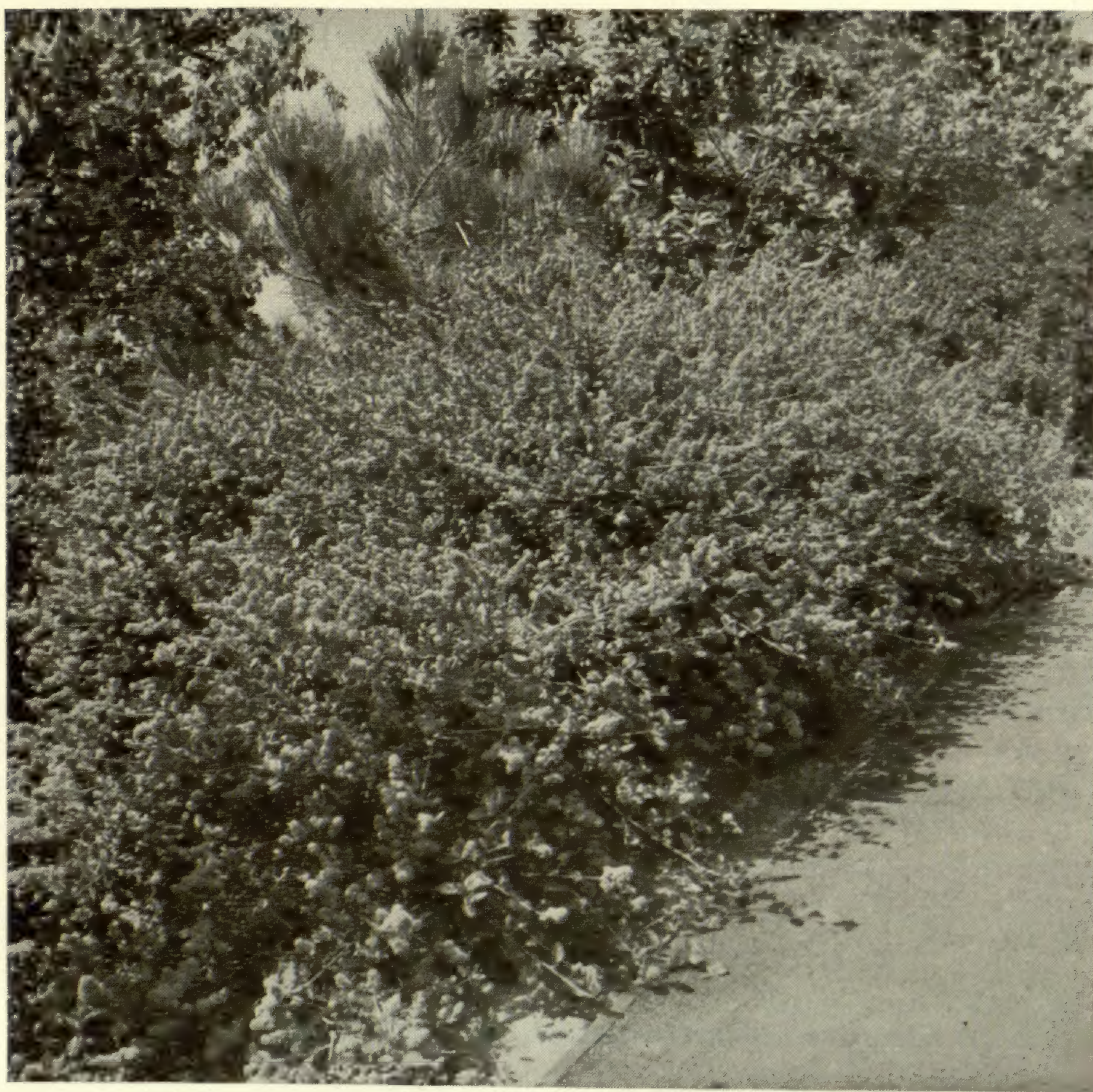
Mr. Edmunds sent us seed from his collection, and we raised several hundred seedlings. These were planted in a variety of locations in the Botanic Garden, mostly in the heavy tight clay soil of Indian Hill Mesa. Flowering started within the second year, and

among one group there appeared a plant with particularly deep, brilliant blue flowers borne in profusion on long pendulous branches. Further propagation by cuttings and constant observation for the last several years have convinced us that it is worthy of consideration by the nursery trade. The interest of several nurserymen, notably Herman Seyfarth of Padua Hills Gardens, Otto Martens of Deigaard Nurseries, and M. C. Peairs of the Claremont Nurseries, further strengthened our opinion that this is a good plant.

Ceanothus griseus 'Santa Ana' was so named by the nurserymen, particularly the Deigaard Nurseries, to designate the type received from this Botanic Garden, and not in honor of the City of Santa Ana located in Orange County. It is a dense evergreen shrub about four to eight feet tall, depending on the area where it is planted, being less tall and more spreading on sharp banks or other uneven ground. The spread may ultimately reach to 20 feet, there again depending on whether it had to be pruned to keep within bounds. The long, thin, green branchlets are angled, more wiry, and with less foliage at the ends than the typical. This is more evident in younger plants and in less rich soils or drier conditions. The leaves are alternate; blades broadly ovate to oblong-ovate, obtuse to acute at apex, generally smaller than typical, being on the average less than one to two inches long, one-half to one inch wide; dark green and glabrous above, light grayish-green to almost green beneath, prominently three-veined from the base, margins less revolute and wavy than the typical. The flower color is a deeper, more brilliant blue than the Cornflower Blue, plate 7/42 of the Royal Horticultural Society Color Chart. The closest match is Ridgeway's Color Chart, Azurite Blue, Plate IX, 53 V.B. They are borne in dense compound clusters, two to four inches long;



Showing profusion of bloom of *Ceanothus griseus* 'Santa Ana'. Photo: Author, April, 1960.



Ceanothus griseus 'Santa Ana' along Entrance Walk to Botanic Garden, planted Dec. 1958. Bush is now 3' tall and 5' wide. Photo: Author, April, 1960

flower bud scales prominent, narrowly triangular with attenuate apex, grayish-green to purple. Flowering period is through March to May or even later, depending on locality and whether in shade or full sun. The fruit is typical of the species.

Since 1952, this cultivar has been propagated successfully at various times from tip cuttings, principally the new growth after flowering, usually ready in May. The cuttings were treated with Rootone, inserted in a medium of 75% perlite (Sponge Rok), 25% peat moss, and kept under intermittent mist with or without bottom heat. Cuttings were also rooted with quite good results during September and December. Cultural requirements preferably are good drainage, a light loamy soil, sun or light shade near the coast, partial shade inland or on hot slopes. However, we have grown it very well in a tight clay loam, in full sun, though the leaves tend to appear a light grayish-green in midsummer, and in very rocky soils. Except for occasional losses, usually not the fault of the plant, our results generally have been excellent in so far as the longevity of the plant is concerned. The writer has grown one at the edge of a lawn for several years without any ill effects. And from a recent report, it is being grown successfully in Nashville, Tenn.

Ceanothus griseus 'Santa Ana' has been distributed to the following wholesale nurseries, botanic gardens and parks: Deigaard Nurseries, Monrovia; Kramer Bros., Upland; Claremont Nurseries; Seyfarth's Padua Hills Gardens, Claremont; Greg's Nursery Service, Gardena; L. L. Edmunds' Native Plant Nursery, Danville, Calif.; Saratoga Horticultural Foundation, Saratoga, Calif.; Santa Barbara Botanic Garden; City of Whittier Park Department; and many other miscellaneous groups.

TRAVEL

The Silent River

PEGGY SULLIVAN

THE COMFORTS OF civilization are delightful, but long periods of civilization can be very stifling for a person! When that occurs, it is best for one to take to the primitive back country. During early September of 1960, this writer plus three other women and six men took to the high mountains of southern Mexico. Object—a week of “river running” in three neoprene rafts. The river chosen this year, begins as the Atoyac, joins the Mixteco to become the Mexcala, which continues to flow west to the Pacific, to be known lastly as the Balsas. Our motley looking group of ten entered the river at the Pan American Highway and left it at the Acapulco highway bridge. It was approximately two hundred miles of sheer botanical delight.

From the very beginning, when we were in the mountains, our rafts threaded through great avenues of feathery *Taxodium mucronatum* submerged in the swollen young river. Later in the hot lowlands, we were “watched” by countless white blossoms of the exotic *Plumeria*, Frangipani, blooming on the banks.

It was interesting to note, in our passage, the day by day change in plant material. During the first day, at 4500 feet elevation, the thick muddy waters flowed swiftly through long colonies of the white flowered Spider Lily, *Hymenocallis*, growing out of the bank at the waterline. While huddled under a shower curtain that night, an unbelievable thunderstorm caused the river to rise six inches and become even more muddy. The following morning only the flower heads were to be seen struggling against the brown current, all else submerged. How could such magnificent white flowers grow from such mud?

And how were we to live through a week of only this river water for drinking purposes? This problem was solved by the writer through the use of powdered lemonade and closed eyes!

With the passing of the days, the *Taxodium* and *Hymenocallis* ceased to appear. The *Nicotiana glauca* dwindled, as well as the “Strangler Fig”, *Ficus aurea*, which spent most of its time wrapped in a hug around the *Taxodium* tree trunks. The only plant to consistently grow along the river from high to low elevation was the bamboo-like *Arundo donax*.

One imagines the tropical forests as containing great cascades of color, but such is not the case. Along our river route, the only dominating colors were offered by the brilliant red and yellow of *Poinciana pulcherrima*, a typical Mexican color scheme. This small tree formed miniature forests along the sand bars. Its masses of flowers were more inebriating than the tejuila at sunset.

Many types of plants were thriving on the limbs of trees, the most unusual being grey haired, fat barrel cactus. The usual orchids and bromeliads were on the limbs, but they were also growing with no difficulty on the vertical rock cliffs. Unfortunately, no orchids were seen in bloom.

During one of the early days of the trip, when Indians were scarce, we were frantically beckoned to shore by the women of a small village. Fearing a “Niagara” around the unexplored bend, we landed, only to discover all the mud and wattle huts deserted. They had fled after giving the frightening warning of large rapids ahead. While waiting hopefully for their return, which never occurred, we admired gigantic blue grey Euphorbia trees casting dramatic shadows on the packed red earth. Over forty feet high, with massive cantelabra arms, they made a safe apartment house for numerous feathered tenants.

As the river flowed from the mountains down towards the Pacific, interesting rapids were encountered. One was so intriguing, that it caused an extensive rip in one of the rafts! Repair of the neoprene took the balance of the day, allowing the afternoon for a splendid climb to the high mountain ridge above the river. Just below the ridge, small springs were enjoyed as well as the wild gardens surrounding them. Gnarled *Plumerias* were in full white bloom, bearing orchids and bromeliads on their lichen covered branches. Large rosettes of an *Agave* were thriving in considerable shade, with strong clumps of *Alocasia* as companions.

The Indian family we encountered living near the springs during the rainy season, as well as those in the four fascinating villages we visited, all must be passed by without discussion. Unfortunately, there is not space here for our many observations of these admirable, rugged people. So resourceful are they, that large gourds, called boomba, are tied to their waists, enabling them to swim the swift current and thereby cross the river.

As the river dropped lower into the tropics, rich deep moss lined the wet earthy banks up to six feet above the water line. This soft green texture was a stunning background to the large, circular leaf of a white flowered *Begonia* which grew pressed flat to the moss. Higher up the mountainside, vast colonies of a thirty foot high cactus, unbranched and stiffly vertical rose above the *Chorisia* trees.

The temperature was rising higher each day and the hehene insects were growing larger and more hungry. Our legs were becoming unrecognizable with swellings and sores from their bites. Yet, a wild red zinnia, *Martynia annua* and *Tithonia*, all three growing profusely together on our sand bar, made it all seem worthwhile.

Even when an untimely submersion soaked off all of the writer's canned food labels rendering their contents a mystery, and an army of ants invaded her raisons, it seemed as nothing. That particular day a wild colony of the Mexican cycad, *Ceratozamia mexicana*, was sighted from the boat and investigated on foot! To climb up and across the hazardous limestone cliff dotted with a red wild poinsettia, only made the discovery more thrilling.

Earlier in the raft trip, lush wide leafed *Thevetias* were sighted hanging over the river banks. Now as we made our last day's run, eight days and almost two hundred miles later, there were *Thevetias* everywhere. But now the leaf was thread-like, although the yellow, oleander-like flowers appeared identical.

It had been a good trip, filled with rare Mexican plants, blue herons, fat iguanas, and best of all, a silent river as our guide.

HORTICULTURE

"Population Explosion" in Plants

MILDRED DAVIS

CERTAIN PLANTS POSSESS the faculty of setting quantities of viable seed, which self sow and come up despite variable soil conditions and some surface cultivation. These plants might be termed the busy or lazy man's solution to a garden of blooms throughout the entire year, and at a minimum of labor and cost. Although they produce many progeny, weeding out surplus is an easy matter. In this category of self sowing plants are annuals, bulbs and perennials. All that is necessary for continuous bloom is the setting out of a few parent plants.

Once planted, Johnny Jumps, *Viola tricolor*, will assure a veritable carpet of charming pansy faces in varying color combinations for months. Only with hot weather do they disappear. Just a few plants allowed to set seed will insure perpetuation for the following year.

For semi-shady areas, Forget-me-not, *Myosotis alpestris*, sends up its dainty blue flowers in mass. Occasional removing of spent blooms will lengthen the bloom period, for it is so profligate with its seed, that the production is a drain upon the plant. Baby Primrose, *Primula malacoides*, self sows, but much more sparingly. To insure perpetuation, remove some mature seed and deposit them in a lightly shaded area where they will be undisturbed until early fall.

In warm years, *Ageratum* blooms and seeds almost continuously. A dwarf white planted in the author's garden over five years ago is still repopulating. The roguing out of tall plants has kept the seedlings fairly dwarf, though somewhat taller than the original.

Baby Snapdragon, *Linaria maroccana*, is an airy miniature snap. Usually sold in a color mixture, separate colors in seed packets can be found with searching. It is seldom offered in flat stock; therefore, they must be started from seed sown broadcast in early fall to early spring. Thinning is not necessary for close growing is essential for any effect.

The population explosion from Moss Rose, *Portulaca*, is terrific. The original seed was sown in my garden five years ago, a lovely pastel strain. Ever since, I have been able to supply the world with seedlings. By roguing, the pastel colors still predominate. Seedlings come up in potted plants, in between the patio bricks, in the asphalt drive, in seed flats and in the compost; however, they are so easy to pull out that they really never become too great a problem.

Incarvillea invariabilis is a much more sedate subject; little known but of easy culture. The foliage is lacy, the flowers trumpet like, white to blush pink. Seed pods are numerous, so need some thinning.

Pigmy Marigold, *Tagetes*, affords lots of flowers over a long period. Flowers are apt to decrease in size if total seed crops are allowed to set.

A number of bulbs, particularly many South Africans, set quantities of seed. They self sow profusely, although the average gardener thinks of perpetuation by offsets only. *Gladiolus tristis*, needs little encouragement, once planted, to 'multiply and cover the earth'. The tall, thin grass-like foliage springs up readily, appearing much like bunches of annual blue grass, but easy to pull out. The flowers are creamy white with a slight greenish tint and are fragrant after dusk.

Freesia, *Ixia*, *Homeria*, *Sparaxis*, *Tritelia* and many others multiply rapidly. Thinning out volunteer seedlings will naturally give better results than leaving all indiscriminately to crowd one another.

There is one summer flowering bulb, *Camassia leichtlinii* hybrid which is a choice plant for any garden. The foliage is Gladiola-like but narrower, and the flowers are borne more like *Watsonia* though smaller. The spikes are starry pink lavender flowers. After the first terminal raceme has flowered, smaller side ones mature. They self sow terrifically.

Among the perennials, there are numerous species which will seed themselves. One Columbine in my garden, *Aquilegia alpina caerula*, self sows eagerly. The foliage is larger than type, the flowers a deep blue and all seedlings are cherished. Strangely enough, these seedlings come true to color.

Santa Barbara Daisy, *Erigeron karvinskianus*, is a dainty fountain-like little daisy. A generous self sower, but never coarse or difficult to control.

Gaura Lindheimeri, a Texas native, seeds with abandon. It grows to three or four feet tall, with many spikes of airy white flowers.

Hibiscus trionum, sold as *H. diversifolius*, multiplies with the zest of rabbits. The foliage is lobed and coarsely toothed; the flowers single, sulfur with a dark eye.

Flowering Tobacco, *Nicotiana affinis*, though a bit weedy for some tastes, is useful for its long bloom and its delightful fragrance after dusk.

Potentilla Warrensi flings its children far and wide. The cluster of clear yellow flowers

arise from basal strawberry-like leaves. They set so much seed that bloom can be retarded on parent plants if all are allowed to mature.

Linaria 'Canon J. Went' reproduces itself profusely. The narrow, grey green leaves are a fine foil for the pink miniature snapdragon flowers carried at the tips.

It is a revelation to see what nature brings easily into the garden by "Population Explosion".

TAXONOMY

Ferns Cultivated in California

BLECHNUM

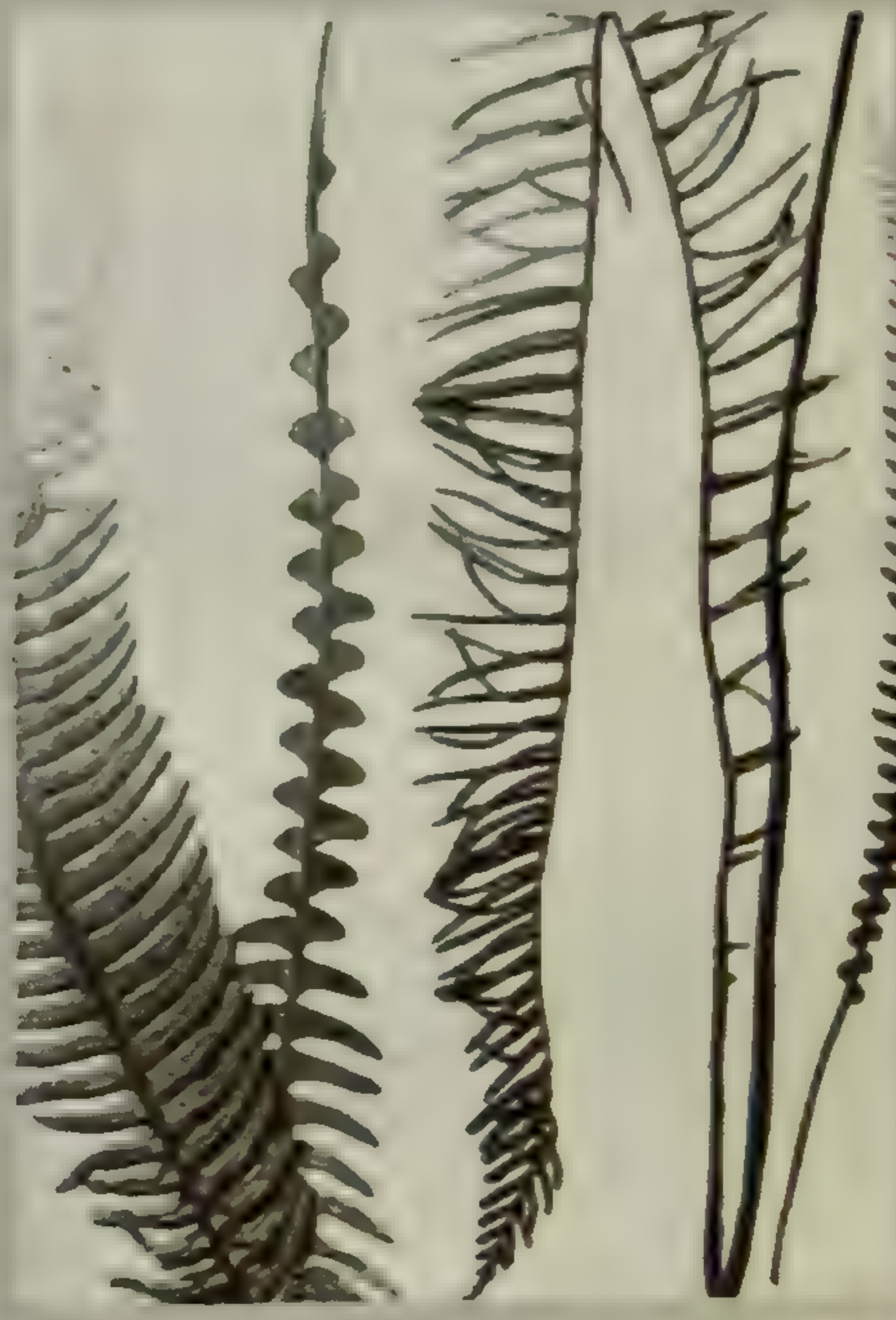
BARBARA JOE

The availability of several fine species of *Blechnum* in the trade has renewed interest in this handsome group of ferns. Some kinds produce fronds which are red or reddish-pink when they are young, further enhancing their ornamental attractiveness. In the trade, a few species are known under the synonym *Lomaria*. The large species, which are considered miniature tree ferns, have proven to be of easy culture and sometimes a welcome change from the usual foliage plants. These subarborescent species, *B. brasiliense*, *B. gibbum* and forms of both, bear their fronds in a circular crown, making interesting accent plants in tubs or containers. *B. gibbum* is reported to have withstood light frost. However, the winter appearance of the foliage, even without frost, leaves much to be desired, except near the coastal areas. One of the varieties of *B. gibbum*, known in the trade under the misapplied name of *B. Moorei*, is superior to the species in that the foliage remains green and attractive throughout the winter months. *B. brasiliense* responds to cooler temperature much as does *B. gibbum*. Because of the more compact nature of the undulate form of *B. brasiliense*, it is less apt to show foliage disfiguration, and is recommended over the species.

Of the smaller species, *B. occidentale* sends out new plantlets at the end of its creeping rhizome and is very useful in borders or background plantings. It is a robust, rapid grower, tolerant of heavier soil and drier conditions than other species. Strong indirect sunlight or direct sunlight along the coastal areas is endured. The ordinary winters of the coastal areas as far north as San Francisco permit maintenance of satisfactory plants so long as some protection is provided. Frost may cause the foliage to brown or become deciduous.

Common in the wilds of the northern part of California is the hardy Deer Fern, *B. spicant*, which forms clumps of tufted foliage from the short-creeping, then erect rhizome. Deer browse on this fern during the summer months. The Deer Fern is raised with some difficulty in the southern part of the state, and never attains the lushness and size of those in the north. All other cultivated species, however, are moderate to quick in growth and present no unusual problems in cultivation. They may be generally said to prefer temperatures of 65 F. or more with lower temperatures correspondingly reducing the amount of new growth and attractiveness of the foliage.

Top row, left to right: *Blechnum gibbum*, habit; *B. gibbum*, frond; *B. moorei*, frond. Middle row, left to right: *B. gibbum*, unnamed variant, habit; *B. gibbum*, frond of unnamed variant; *B. spicant*, frond. Bottom row, left to right: *B. unilaterale*, frond; *B. brasiliense* cv. 'Crispum', frond; *B. brasiliense* cv. 'Crispum', habit. Photos by author.



The *Blechnums* are propagated by spores. *B. occidentale* and *B. spicant* are also easily propagated by divisions. Established clumps of the latter are the usual manner in which this fern is furnished to the nurseries. Subarborescent species occasionally produce new crowns of foliage on the trunk or near the base. If these crowns are carefully removed with a portion of the stem attached, it is possible, but not without difficulty, to start new plants with the off-shoots.

The *Blechnums* are typified as terrestrial or subarborescent ferns with a rather coarse and stiff habit. The fronds are usually arranged in a circular pattern. The rhizome is creeping to erect or trunk-like. The scales on the rhizome and often on the tips are linear and harsh. Some species have contracted fertile fronds. The fronds are usually deeply pinnatifid or pinnate, herbaceous in texture, and smooth. The margins are entire or serrate. The veins are free, forked and subparallel. The long linear sori are continuous along each side of the midvein. Each is covered with a flap-like indusium, which is long and linear in shape, parallel to and opening toward the midrib. The two hundred species of this group are largely distributed in the southern hemisphere with some in the tropics of the northern hemisphere, and one species, *B. spicant*, is the North Temperate Zone.

Species which have contracted fertile fronds were formerly placed in the genus *Lomaria*. This separating character has recently not been considered significant because some species have been found to have varying degrees of contraction.

The following is a key to the species known to be cultivated in California:

- A. Fertile fronds reduced or contracted.
 - B. Sterile fronds oblong, elliptic to oblong oblanceolate, 5 in. or more wide; small tree fern. *B. gibbum*
 - BB. Sterile fronds lanceolate, not more than 5 in. wide, generally less; not a small tree fern. *B. spicant*
- AA. Fertile fronds the same as the sterile.
 - B. Fronds pinnatifid or with the lowest pinnae free.
 - C. Fronds lanceolate, 1½ to 3 in. wide, not a tree fern, Rare in cultivation. *B. unilaterale*
 - CC. Fronds oblong-lanceolate, 1 ft. or more wide; subarborescent. *B. brasiliense*
 - BB. Fronds simply pinnate in lower half or more. *B. occidentale*

Blechnum brasiliense Desv. Subarborescent; trunk stout, 1 ft. or more high, the scales dark brown, densely covering the crown; stipe short, stout, densely scaly; fronds erect, to 3 ft. long, to 1 ft. or more wide, pinnatifid, oblong-lanceolate, narrowing downwards very gradually; pinnae usually gradually tapering to the apex, finely toothed, the upper ones 4-6 in. long, ½ in. wide, the lower ones connected, shorter and blunter; texture leathery, both surfaces naked; veins free; sori close to midrib. Brazil and Peru. To 4 ft. Semi-hardy to tender. Shade. Accent, suitable in containers.

cv. *crispum* (*B. corvadense* var. *crispum*). A form with undulate margins, crowded pinnae and smaller fronds which are red when young. More commonly cultivated than the species, the foliage remaining in good condition throughout the winter in coastal areas.

Blechnum gibbum (Lab.) Mett., (*Lomaria gibba* Lab.). Small tree fern; trunk to 3 ft., covered with black scales; leaf stalk and lower half of the midrib scaly; sterile fronds

Top row, left to right: *Blechnum occidentale*, habit; *B. occidentale*, frond; *B. fraxineum*, frond. Middle row, left to right: *B. discolor*, frond; *B. auriculatum*, frond; *B. servulatum*, frond. Bottom row, left to right: *B. fluviatile*, portion of frond; *B. lineatum*, frond; *B. orientale*, frond. Photos by author.



spreading almost horizontally, 2-3 ft. long, oblong elliptic, pinnatifid almost to the midrib; sterile pinnae many, 4-6 in. long, $\frac{1}{4}$ - $\frac{3}{8}$ in. wide, tapering to a bluntish point, the bases dilated and connected to each other, the lower pinnae gradually shorter, the lowest distal and free from each other and usually broadly attached to the midrib; margins entire or finely serrate especially near the pinnae tip; texture herbaceous to leathery; fertile pinnae contracted, 4-6 in. long, usually $\frac{1}{8}$ in. wide, in cultivation frequently but slightly contracted. N. Caledonia, Aneiteum, Isle of Pines in South Pacific. To 4 ft. Semi-hardy to tender. Shade. Accent, suitable in containers. Subject to fungi, best to avoid overhead watering. Variable in cultivation.

cv. *platypteris* Hort. A large rapid growing form with many erect fertile fronds bearing sterile spores. Appears infrequently in spore cultures of the species.

Plants erroneously passing as *B. moorei* in the local trade are a distinctive cultivar of *B. gibbum*, which to the author's knowledge has not been given a proper name. It is distinguished from the species in having fewer, more leathery, erect fronds with fewer pinnae; pinnae wider $\frac{3}{8}$ in. or more, conspicuously serrate, the lower pinnae frequently subsessile to almost stalked; apex of pinnae in younger fronds rounded; leaf stalk, midrib, and costae of young fronds reddish-pink. Semi-hardy. Evergreen. Spores of this cultivar (or variety) were introduced from Germany by Mr. A. W. Roberts of Subtropical Gardens Nursery.

The true *B. moorei* C. Chr. which is not known in local cultivation has the leaf stalk equal to or half the length of the blade, the apex of the pinnae frequently truncate or bifid bearing a fringe of cilia and the base of each pinna slightly lobed on the lower side. *Blechnum occidentale* L. Rhizome creeping underground, forming new plants at the apex, crown clothed with scales; stipe 6-12 in. long, erect, scaly below; fronds 9-18 in. long, 4-8 in. wide, pinnate to pinnatifid with 12-24 linear pinnae on each side; pinnae



Blechnum brasiliense, frond.



Blechnum capense, frond.

Photos by author.

3-6 in. long, $\frac{3}{8}$ - $\frac{3}{4}$ in. wide, narrowed gradually to a bluntish point, the upper pinnae broadly joined to the rachis, connected to each other then gradually becoming distal below, the lower pinnae truncate, cordate, or sometimes eared at the base, often 1 in. apart, and the lowest pair deflexed, but much smaller than those above; texture leathery. American from Mexico and W. Indies southwards to Chile and south Brazil. To 1½ ft. Semi-hardy, deciduous when frosted. Tolerant of strong light, heavy and drier soils; robust, of easy culture. Border or background.

An unnamed cultivar is occasionally found having a stiffer, stricter habit, and more red color than the species. It is not as robust.

Blechnum spicant (L.) Roth, (*Lomaria spicant* (L.) Desv.). Tufted ferns; rhizome stout, scaly; fronds pinnatifid, dimorphic, the sterile fronds to 3½ ft. long, to 5 in. wide, nearly sessile or on stipes 2-3 in. long, the blade pinnatifid to the midrib, lanceolate to linear in outline, narrowed gradually below, the pinnae many, closely placed, oblong or oblong-linear, often falcate, the apex obtuse to acute; fertile fronds taller, more erect, the stipes to 9 in. long, dark and polished, the pinnae less crowded, very narrow-linear, sessile by dilated base, sporangia covering the backs of pinnae. Northern hemisphere. To 3½ ft. Hardy. Shade. Not well adapted to southern California.

Blechnum unilaterale Swartz. Rhizome slender creeping, then erect; fronds to 2 ft. long, to 3 in. wide, lanceolate, pinnate at base, pinnatifid upwards; pinnae numerous, spreading, linear, $\frac{3}{4}$ -1 in. long, the lower distant, small, broader than long, irregularly triangular, the margins entire or nearly so. Tropical America. Known in cultivation only from a single plant at Jungle Garden Nursery, Culver City, California.

CTENITIS

A modest fern often overlooked in the garden, *Ctenitis pentangularis*, is one of the many introduced from New Zealand. It has no common name but the botanical name is informative. *Ctenitis* means comb-like, referring to the form of the pinnae and *pentangularis* means five-angles, alluding to the outline of the frond.

Compact clumps of this fern are generally found tucked along a border, more than often obscured by some larger plant. The lacy broad fronds are fairly tolerant of irregular watering, and fortunately are not relished by slugs and snails. Though this plant is slow in growth, it does not seem to be particular about soil or fertilizer. However, ferns which are fertilized are much improved in having a deeper color, larger fronds, and more rapid growth. Prize specimens may also be grown in pots or containers. In southern California it is considered a semi-hardy species, having withstood temperatures to 32°F. Colder conditions, possibly to 26°F. for short periods, may also be endured. Propagation is by spores and easily by divisions. Today it is rarely found in the nursery trade, commercial growers preferring plants with more rapid growth and tropical effect.

The 120 species of *Ctenitis* existing in the tropics may be recognized from others by the following characteristics. They are medium size to large ferns with short creeping to erect rhizomes which are covered with a dense mass of soft scales. The fronds are usually amply divided and broad at the base. The bases of the upper pinnae extend down the midrib as a narrow leafy portion known as the wing. The texture is herbaceous. The midribs of the pinnae do not have raised edges. Along the midribs of the frond and pinnae are some scales and many matted soft woolly jointed hairs. These hairs are more conspicuous on the upper surface and are a light color when young or a rusty color when old or dried. The veins are free, simple or forked. The sori are round and small, formed on the backs of the veins. A round kidney-shaped indusium is usually present. *Ctenitis* species were formerly grouped under *Dryopteris*.

Two species are reported to be cultivated in United States, but only the following is known in California.

Ctenitis pentangularis (Coe.) Alston, *Dryopteris decomposita* of New Zealand authors. Fronds triangular, tripinnate, to 2 ft. long, to 1 ft. wide, hairy, the lobes obtuse at the apex; indusium present. To about 2½ ft. tall, usually less. Shade. Semi-hardy. Evergreen. Growth rate slow. New Zealand. Confused with *C. decomposita* (R.Br.) Copel. which is also reported to be cultivated. *C. decomposita* is native to Australia and differs in being larger, with the segments acute at the apex and with fewer teeth on the sides of the lobes.

The presence of a round kidney-shaped indusium in *Ctenitis* as well as other genera may cause some confusion. *Ctenitis* may be distinguished from the firm textured *Dryopteris* by the presence of hairs on the main veins, and by the absence of a raised edge on the costae. *Thelypteris* species have hairs, but the hairs are single celled; the fronds are narrow rather than broad at the base. *Tectaria* species are coarsely cut and have netted veins.

Alston, A.H.G. 1955 A New Combination in *Ctenitis*. American Fern Journal 45:160.



Ctenitis pentangularis, frond. Photo by author.

HISTORY

The Restorations at Rancho Santa Anita

SUSANNA BRYANT DAKIN

THE HISTORIC HOMESITE

Welcome to the historic homesite of Rancho Santa Anita! Gabrielino Indians, of Shoshone stock and tradition, were first to enjoy this "Place of Many Waters" which they named *Aleup-kig-na*. Archaeologists and historians have been aided in re-creation of a vanished way of life by the discovery, through the years, of arrow points, fish hooks, soapstone pestles and pots, a variety of baskets, ceremonial and cold weather clothing, shell and bead and seed ornaments, shell money, human and animal bones, traces of habitations. The tule houses (called *jacales* by the Spanish conquerors of California), outside the west wall of the *adobe* ranch-house, have been made just as local Indians made them for hundreds of years, from bent willow branches and tules growing in the marsh that now is a beautiful lake.

In large numbers, long ago, these people provided themselves with a plentiful supply of food through ingenuity and hard work, characteristic of the maligned California Indians. Fish and birds abounded—for the catching, snaring or shooting—and the people also ate snakes and other animals, excluding only the rattler and the bear whose black body was feared to contain a wizard's soul. All their food—animal and vegetable—was eaten cold and their teeth did not decay, according to Hugo Reid who was the first private owner of Rancho Santa Anita, besides being a pioneer anthropologist. Before coming to the New World, this Scot had been a classmate of Charles Darwin at Cambridge University and there he had learned to use scientific method in his observations. He claimed that Gabrielinos living in a natural state "carried their teeth perfect to the grave", so healthy was their diet.

Local trees and plants provided edible acorns, mountain cherries, *chia* (the blue-flowered sage from which a mush was made), roots, berries, fruits. Various reeds and grasses were used for weaving baskets and thatching houses. Waterproofing was done with pitch formed at surface oil pools. Soap came from a star-flowered marsh plant; and the Indians knew all sorts of medicines derived from what we consider mere weeds. Hugo Reid married a chieftain's daughter who remembered many of the ancient recipes and remedies. The Indian "Doña Victoria" Reid was revered by the *paisanos* for her healing powers.

After Spanish priests and soldiers claimed the whole of California for the King of Spain—after the founding of San Gabriel Mission by the Franciscan Order in 1771—the Indians' "Place of Many Waters" became a mission *rancho* of more than 13,000 acres supervised by the *padres* and worked by their Indian "children". Imported black cattle grew fat on foothill grass; vegetables, fruit trees and grapevines were planted near the springs which feed "Baldwin Lake" to this day. The gnarled old pomegranate south of the *adobe* dates from mission *rancho* days, when the name of Santa Anita was given to this historic homesite. The huge rendering kettle near the tule houses was used by the *padres* and converted Indians in making tallow for a flourishing mission trade with American and European vessels.

Hugo and Victoria Reid built and used the *adobe* during the 1840's while cattle-ranching was still a way of life in California. Hospitality provided by the *rancheros* became proverbial. The American conquest ending the Mexican War, in 1847, ended an era—and spurred the sale of Santa Anita that same year. For 20¢ an acre Don Hugo

was forced to sell the choice property that he had been given by the Mexican government less than a decade earlier.

The Reids retained a western section of the original mission *rancho*. This was known as *Huerta de Cuati*, "Orchard of the Twin" (later, as "Lake Vineyard") and had been given to Doña Victoria by the *padres* in appreciation of her many mission services. A grant from Mexican Governor Alvarado secured the title for her, following the Secularization Act. Even then, while legal it was rare indeed for an Indian to own a fine *rancho*. After the sale of the historic homesite at Santa Anita, Don Hugo built a spacious *adobe* ranch-house on his wife's dower land. This overlooked the clear, natural lake at *Huerta de Cuati* which—a century later—has become a city park. It has been established that three houses were erected by the "Scotch Paisano" within a few miles of San Gabriel Mission, yet not a trace of his building remained anywhere except at Santa Anita, when the Arboretum's restoration program commenced in the 1940s.

Hugo Reid was happily married from 1837 until his untimely death in '52, to the beautiful and intelligent "Doña Victoria". He gave her the name of the young Queen being crowned in England while they were being married in California. Following the San Gabriel Mission ceremony, week-long festivities centered at Rancho San Pascual (mostly Pasadena, today), the home of Doña Eulalia Perez who had acted as foster-mother to "Victoria" since her mission childhood. Don Hugo became an eloquent and effective champion of his wife's people—through the writing and publication of twenty-two "Letters on the Los Angeles County Indians". These informed and interesting essays have contributed immeasurably to our understanding of the original owners of Rancho Santa Anita—of their natural way of life, and their sad decline after "conversion".

RANCHO SANTA ANITA

Chain of Title

King of Spain—1771
 The Mexican Nation—1882
 Hugo Reid—1839-'45
 Henry Dalton—1847
 Joseph A. Rowe—1854
 William Corbitt and Albert Dibbles—1858
 William Wolfskill—1865
 Harris Newmark—1872
 Elias Jackson Baldwin—1875
 Harry Chandler—1936
 State of California—1947

From the King of Spain to the State of California, each ownership of Rancho Santa Anita has represented an important era in California history. The Los Angeles State and County Arboretum occupies a fragment (127 acres) of the huge land grant which Hugo Reid received from Governor Alvarada, soon after secularization of missions in the 1830's. Of all the owners of the changing land, only Reid and Baldwin left an architectural imprint. Don Hugo built the *adobe* ranch-house; and Mr. Baldwin, the Victorian frame buildings known as the "Queen Anne Cottage" and "Coach Barn". Some plantings of the early owners has survived inroads of time and neglect, and is shown during Arboretum tours. Reid, Dibble, Wolfskill and Baldwin were horticultural pioneers.

Changes in the original ranch-house have been made by each successive owner from the pioneer circus-man, Rowe (in the 1850's), to Baldwin, rich from Ophir mine in the Comstock Lode. In 1879, "Lucky" added a frame wing to the west and used it as his living quarters on visits from the north. He died in the transformed *adobe* in 1909; and

all of his building fell into sad disrepair, including the elegant "cottage" which he reserved for entertaining, and the barn where his horses once lived in style and his carriages were kept.

Not until 1947—just one hundred years after Reid's sale of the Santa Anita to Henry Dalton—did the historic homesite become State-owned and leased to Los Angeles County as an Arboretum. Two years later the non-profit California Arboretum Foundation, with private funds, commenced restoration of the "Queen Anne Cottage". This was completed in 1954; costing about \$75,000, and dedicated as Historical Landmark #367 of the State of California.

The Coach Barn, Boat House, Victorian Rose Garden and the Hugo Reid *Adobe* have been restored by the State Division of Architecture through funds provided by the Department of Natural Resources, Division of Beaches and Parks. The old ranch-house was scarcely recognizable as an *adobe* because of the frame additions including a Victorian veranda which Mr. Baldwin lighted with Chinese lanterns. The roof was tile, north to south; and shingled to the west. A climbing banksia rose hid many incongruities. After an extensive archeological and historical survey, authorities decided to raze the frame west wing and restore the ranch-house to its size and appearance in the early 1840's—to Reid ownership of Rancho Santa Anita. This was a difficult decision because, to many people, the Baldwin building seemed mysterious and charming in its old-fashioned, overgrown garden setting, open to the Lake. Dilapidation was not immediately apparent, beneath a blooming rose vine.

Now the architectural work is done, and it is easy to imagine that Don Hugo and Doña Victoria—hospitable, handsome people dressed Spanish style—may be waiting to greet the visitor in the soft Spanish tongue (native to neither, but spoken daily in California a century ago): "*Buenos días, Amigo!*"

THE HUGO REID ADOBE

The *patio* of the Reid ranch-house is well equipped for outdoor living—enclosed by high adobe walls, with a reed covered *ramada* (arbor), a *horno* (beehive oven), *brasero* (open fire pan), a center well, a huge water kettle, a wine press, tables and benches, shade trees, a kitchen garden. The cool, dark interior contains three rooms planned for a *sala* (living room), *alcoba* (bedroom), office and storage space, all with hard packed earthen floors*. The handsome flat roof is reed tied with rawhide strips and water-proofed, to a degree, by *brea* (asphalt). Don Hugo was an innovator who inserted glass into his windows; but in every other respect, his adobe is typical of "Los Angeles Style" residences in the 1840's, in semi-tropical southern California.

Beginning in 1839, Reid planned and built the adobe at Santa Anita as an indispensable store house and ranch office; also as a place for his family to spend an occasional night in informal comfort. The young ones 'camping out' in the patio. Two years earlier, at the time of his festal wedding, he had designed and supervised the building of an impressive two story home near the Mission in the frontier community of San Gabriel. This became a landmark and served almost as a hotel for visiting Europeans and Americans. The enterprising Scot had used Indian labor to cut and haul wooden beams for the San Bernardino Mountains, to make adobe mud bricks mixed with grass, to find and pound seashells for lime, to whitewash inside and out of the completed edifice. Learned from the *padres*, this procedure was followed in smaller scale at Santa Anita.

*Authentic furnishing of the *Adobe* is being financed by Colonial Dames, traditionally interested in historical restoration. This, their first restoration in the West, is being planned by Mr. Gregor Norman-Wilcox associated with the Los Angeles County Museum of Art, History and Science. When completed, the Adobe interior will be described in detail, both in Lasca Leaves and in Arboretum tour talks.

By the time the ranch house was finished, the Reid household had grown to contain at least six children, several from a child marriage of Victoria to a mission Indian called Pablo. Married at thirteen, she had been widowed in her twenties during a smallpox epidemic which decimated the Gabrielinos. Don Hugo always treated her Indian children as his own, giving them his name; and he supervised the schooling of both boys and girls in a community lacking schools, even interest in education.

Meriendas (outdoor meals) at the *rancho* were frequent adventures for the Reid family and their friends of all ages. Men and boys would ride the few miles over from San Gabriel, often at breakneck speed, showing off to the women and children crowded into calico lined, canopied *carretas* drawn by oxen. Someone always carried a guitar, or violin, for singing and dancing in the long summer evenings. Tall, blue eyed Don Hugo was the dominant figure, in demand for his translations of English songs into Spanish (like "Home, Sweet Home"). He had a fine tenor voice.

The food was 'sumptuous' according to an old friend, William Heath Davis, who would visit the Reids on business trips up and down the coast. He once said of his Indian hostess; "A Castilian lady of standing could not have bestowed upon us any greater attention or graciousness".* His descriptions of meals, especially during the Christmas festivities, are mouth watering. In old age, he recalled the Santa Anita as "a



On the westside, outside the walled courtyard of Hugo's home, one finds the tule houses (*jacales*) of the Indian servants, a large open kettle set for heating, a reed covered *ramada*, a hide stretched on a rack for curing, fruit trees and a young vineyard. A corner of the rail corral is visible, where long eared "Pancho" brays his welcome to passing visitors.

*From a manuscript in the Huntington Library. Davis' book "Seventy-five years in California (1831-19066)" has become a classic of Californiana.

rancho of about eight thousand acres . . . then the most picturesque spot of Southern California, with mountains, valleys, springs and running silvery streams. You would observe in riding over the rancho its having more than its pro rata of towering and over-spreading liveoak trees, manzanita, laurel and other forest in comparison with other ranchos." Davis described his host; "Reid was a cultivated and educated man, a big hearted man, a thorough accountant and bred as a merchant in his own country."

After the sale of Santa Anita, Hugo Reid achieved fame as a writer and he helped to steer California into statehood, as an honoured and hard working delegate to the Constitutional Convention. At forty-two, in 1852, he died from a recurring chest complaint without ever making a fortune, even when he joined the Gold Rush. His whole life contrasted with that of "Lucky" Baldwin, whose aims were material, whose health was excellent and who 'struck it rich' in silver mining.

* * *

As the Arboretum visitor leaves the adobe ranch house, the tule *jacales* of the Reid's Indian servants, the orchard and vineyard, the corral containing long eared, braying "Pancho", the ducks and gamecocks—he walks through a screen of shrubbery from one world into another, along the edge of Baldwin Lake. A boat house is the first arresting sight in a sophisticated setting; then comes the candy stripe "cottage" with its high tower and stained glass windows. It would not be surprising, now, to see Mr. Baldwin in his Prince Albert coat and broad brimmed black hat, escorting Lily Langtry or some other star of the Baldwin Theatre down the marble steps to his Tally-Ho below. Descendents of his peacocks still preen themselves, on a lawn of "Baldwin grass" sloping to the water.

THE QUEEN ANNE COTTAGE

"Lucky" Baldwin's daughter Anita named the "Queen Anne Cottage", for reasons of her own. In 1880-81 her father had built it for her mother, his third wife, who died at twenty-three. Inside, there are two portraits of this pretty, dark haired Jennie Dexter Baldwin; one, in the stained glass front door and the other, an almost life size oil painting on the west wall of the front parlor. In the study is a large landscape painted in oils by H. H. Cross in 1889. A bearded Baldwin occupies the foreground in fashionable attire, even to grey kid gloves, surrounded by mastiffs, in company with a young girl, hair hanging down, wearing a short, black bustled dress. This is the motherless Anita. Across the Lake, left background, is pictured the fanciful red and white "Queen Anne Cottage" looking spruce as it does today.

After Mr. Baldwin's death in 1909, all detachable integral parts of the elegant "cottage" which had become his guest house, were carefully crated, under his daughter's supervision, and stored in the Coach Barn for forty years. In remarkably good condition, when restoration commenced, was the stained glass ordered in England, picture windows for all the rooms including Shakespeare in the study, nymph scenes in the bathroom, and the portrait front door; the beautiful black walnut doors with their tooled hardware, white marble fireplaces flecked with gold, intricate marble and tile paving for the front hall and whole outside entrance. A German carpenter who had worked on the place seventy years earlier, recalled details of trim, interior colors and furnishings, with fantastic accuracy. In 1881, he had been on hand for the arrival by "Iron Horse", Southern Pacific from San Francisco, of flowered carpeting, crystal chandeliers and long gilt mirrors. Where the original Baldwin furnishings have disappeared, it has been possible to replace them essentially as they were. For instance, paisley draperies, lace curtains, a fringed table cloth and a beaded footstool were acquired at the fabulous Mills auction in Millbrae. Both Darius Ogden Mills and Elias Jackson Baldwin can be classified as "Bonanza Kings" and their tastes were similar in interior decoration. Neither spared expense; and both acquired *objets d'art* at the Philadelphia Exposition of 1876.

There have been many gifts, of suitable furnishings and money, none more welcome

than the family paintings and Mr. Baldwin's own marble top table, to be seen in the bedroom. There are four sizable rooms and a bath, by now completely furnished; and a veranda running around the house, besides the three story tower with narrow stairs winding up to a wonderful mountain view. The architect was A. A. Bennett who is remembered for planning the State Capitol at Sacramento. The formal garden had been neglected, but now is beautifully restored by members of the Pasadena Garden Club. Special features are the giant clam shells, brought by Mr. Baldwin from the Great Barrier Reef; his mounting block by the marble approach and stairway to the veranda; a deep artesian well doubling as a decorative fountain, surrounded by old fashioned roses.

Everything in the Cottage can be seen by walking around the veranda and peering in at the windows. The bedroom is closest to the front steps; then comes the front parlor with an ever-burning fire and a lady always ready to go out, in bustle and bonnet. Notable here are the paintings, gilt framed, and the over mantel gilt mirror; rosewood sofa and love seat upholstered in red velvet, paisley draperies with red velvet valances; a beaded footstool and beaded flowers in the hand of a weirdly Victorian blackamoor; a silver *épergne* full of fruits and flowers. In the music room is a melodeon, a harp, an old piano and music boxes; a chess set laid out on one small table, and tea service ready on another. An elaborately dressed mannequin, reflected in a long mirror, gives an illusion of occupancy to the room, indeed to the whole house. This restoration is transporting, in atmosphere, due to the imagination, knowledge and skill of Mr. Maurice Block. He directed many volunteers and inspired many gifts, during the furnishing period.

On the piano rack is appropriate sheet music titled "If Your Foot is Pretty, Why Not Show It?", "Champagne Charlie", "Kiss Me Mother, Kiss Your Darling". There is a study and a bathroom with Victorian accessories, but no kitchen. In Mr. Baldwin's day, Chinese servants prepared food in the transformed adobe, then carted it across to the Cottage. They could be summoned by embroidered bell pulls. Chinese lanterns recently have been found, to light the veranda.

From handsome iron furniture on the lawn*, a visitor gazes one way across the Lake to the Adobe, simple in its pastoral setting; the other way, over a velvety Mall shaded by ancient trees, to the Coach Barn. This is similar in architecture to the Queen Anne Cottage. It was built in 1879, when the Adobe was transformed to serve as living quarters for the Baldwin household and guests, on visits to the Santa Anita from San Francisco. The Cottage was not completed until well into 1881.

THE COACH BARN

"O, to have been a horse on the Baldwin ranch!" "Lucky" Baldwin treated his horses more tenderly than some people treat their children. Immaculate stalls in the restored Coach Barn contain novel hay shoots, sliding doors, beautifully wrought iron fretwork. Paneling throughout is of alternating redwood and white pine. The front section was used for carriages; the rear, for the horses; harness was kept in two tack rooms; and grooms slept in the hay loft, less luxuriously than the carriage horses.

Usually standing on the wash rack is the Tally-Ho, a gift of the Baldwin family. It was built to "Lucky's" specifications and displayed at the Philadelphia World Fair in 1876, where he made many purchases for his San Francisco hotel and theater, his home on "Nob Hill"; and his proposed buildings on the Santa Anita. The Tally-Ho was expensive, costing as much as a new Cadillac in 1960. It was used to meet guests and for country outings, *meriendas*. Hugo Reid would have called them, providing an ice compartment for champagne, wicker food container, rack for ladies' parasols and so on.

Other items of interest now stored in the barn are the old fire fighting wagon used

*A memorial to Dewey Nelson, who we honor as the indispensable first Curator of the Arboretum's Historical Preserve.

on the Baldwin ranch; the safe from "Lucky's" Oakwood Hotel in Arcadia, probably containing treasures (the lock is sprung); an Indian exhibit in cases against the north wall of the coach room. Many artifacts have been found here at *Aleup-kig-na*, the Gabrielinos' "Place of Many Waters", and there are changing loans from the Southwest Museum.

Now the Arboretum visitor has seen all that remains of the historic buildings on the homesite at Rancho Santa Anita. As he leaves the Barn through the west door, he may take time to admire the ginkgoes and other trees that Mr. Baldwin brought in as seeds or seedlings from China and India; the huge elms from "Lucky's" birthplace in the one-time wilderness of Ohio; the eucalyptus, catalpa and palms dating back to earlier owners. These distinguish the grassy Mall from an ordinary lawn in southern California, more recently and less imaginatively planted. English daisies and "Naked Lady" lilies are to be seen in their season, and rarely beautiful is the catalpa in full bloom.

Across the road, there is the Herb Garden; then the walled fragrance area with easily followed paths, designed especially to give pleasure to the blind. Turning southeast, our visitor enters the Rose Garden, both fragrant and full of color. Southwest, up Tallac Knoll and through a native oak forest, there are the Biblical and Tropical plantings and a natural amphitheater. So many paths to choose from! Some lead away from the historical buildings and gardens, around the Lake and into the Jungle (used for innumerable movie sets), over to the experimental lawns, the Home Gardens, the Orchid House.

Come again, come often.

There always will be something else to see, some other path to follow.

Hasta la vista! Hasta luego.

COVER PICTURE

Site of the beginnings of Rancho Santa Anita, the Hugo Reid Adobe, now a portion of the Los Angeles State and County Arboretum. This picture was taken early on a Saturday morning before Hugo and "Doña Victoria" had arisen, before their children left the patio for the day's explorations or even before the Indian servants had started their chores! Only a few ducks and a black swan, float quietly on the lagoon, waiting for their morning feed of grain.

HORTICULTURAL EDUCATION PROGRAM

offered by

Los Angeles County Department of Arboreta and Botanic Gardens

LOUIS B. MARTIN

ADULT EDUCATION

The Los Angeles State and County Arboretum will open its 1961 Adult Education Program in horticulture and botanical science with nine courses, starting Monday, February 6.

The following courses are co-sponsored with the Arcadia School District, Adult Education Department:

1. Home Horticulture—Don Woolley, Instructor
2. Plant Propagation—George Lewis, Instructor
3. Home Landscaping—Tom Parker, Instructor
4. Plant Identification—Dr. Leonid Enari, Instructor
5. Botanical Sketching—Gerry Patten, Instructor

Four professional courses are co-sponsored with the University of California, Los Angeles Extension Division:

1. Plant Materials in Landscaping for Professionals—Philip Chandler
2. Sprinkler Systems in Landscaping—Norman Hammer
3. Professional Practices in Landscaping—Scott Wilson
4. Turfgrasses and Ground Cover Management—Dr. Victor Youngner

With the exception of the Botanical Sketching, all these courses are held in the evening, 7 to 10 PM. The first five courses have 14 sessions, the last four have 12 sessions.

The Descanso Gardens Division of the Department, located in La Canada, California offers four courses. These courses are co-sponsored with the Pasadena City College, Extended Day Division:

1. Introduction to Home Landscaping—Mark Anthony
2. Landscape Construction—Frank Halvorsen
3. Orchid Culture—Glenn Hiatt
4. Botanical Sketching—Gerry Patten

CHILDREN'S EDUCATION

Four classes in nature and gardening subjects will be given at the Los Angeles State and County Arboretum. This program will begin in mid-January, ending just before Easter vacation in late March. New facilities ready for class use include a nature museum, a greenhouse and a potting yard.

"Indoor Gardens" is planned for first and second grade children. They will propagate plants from seeds and cuttings, make planters and terrariums and visit Arboretum gardens.

"Exploring Nature" will find third and fourth grade children on field trips around the lagoons and gardens. They will also have indoor projects based on their outdoor discoveries.

"Greenhouse Gardening" will provide a number of fascinating propagation experiments and projects for seventh and eighth grade boys and girls.

"Gardening" for grades four, five and six provides individual plots where each student prepares, plants and cultivates vegetables, herbs and flowers. This is an 18 week course.

At the Lakeside Cottage, the Children's Education area for Descanso Gardens, three courses are offered: (a) Indoor Gardens, (b) Exploring Nature, and (c) Gardening. Course content and age groups are similar to the courses given at the Arboretum.

AGRICULTURE

California's Glamour Crop

ALEXANDER KING

Recently, while I was in San Francisco, I visited the California Wine Institute where I was able to gather some data on the history of California wines which is of interest and importance to the wine industry.

The beginning of California's wine industry is said to date back to the Franciscan missionaries. Father Serra planted cuttings from Spain, which we now know as the Mission grape. The first cuttings were planted at Mission San Diego in 1770. The vines were sturdy and they prospered but the wine was harsh.

With the Gold Rush, California was invaded by a cosmopolitan company of adventurers from France, Germany, Austria-Hungary and Italy, who brought cuttings from their native lands. In this group was Count Harazthy. He was considered one of the most remarkable of the early '49ers and more than a score of publications have been written about his life. He planted vines from his native Hungary. They were shipped around the Horn packed in straw. Among these was a vine known as Zinfandel, which was later to change the wine industry in California. He planted the cuttings near Sonoma, and his chief stroke proved that the grape vine would grow in California without irrigation, and would flourish best on Northern hillsides. The remote valley of Sonoma was swept with a wave of inquiry and curiosity. It had suddenly become the center of viticulture knowledge. His Rancho Buena Vista was the supply base of foreign vines for the entire state. Later, in addition to the Zinfandel, he imported Flame Tokay, Riesling, Black Morocco, and the Muscat from Alexandria, that were grafted on the sturdy Mission root stock.

Harazthy was sent on a mission to Europe by Governor Downey in 1861. He brought back thousands of additional cuttings from all over Europe, Asia Minor, Persia and Egypt for experimental purposes. California was now wine conscious, and as a result of this mission, Buena Vista became the incubator of California's present wine industry and today practically all wine grapes in the west have European blood in their veins.

About this time, a vicious pest, known as *phylloxera*, or root louse, settled on the European vineyards. It ravaged the continent for twenty years, practically destroying all the vines.

Strangely, the expedient of grafting by Harazthy and his followers, the original foreign cuttings on American root stocks (all of them of the Mission variety introduced by Father Serra) developed an immunity to the root louse. These were rapidly grafted to the European vines, and to this day no European vineyard produces wine, except through American roots.

California, by virtue of its equable climate, possesses a monopoly of the *Vitis vinifera*, or European variety of grape. In the eastern and Great Lakes states, one finds the Wild Fox grape. This was the grape observed by Leif Erickson, who first saw America about 1000 A.D. This wild grape was hybridized to produce the Catawba Concord and Delaware, the wines of which bear no relation in texture, bouquet, and flavor to the European and California variety. Some experiments are now being made in grafting the European stock in the Finger Lake district of Northern New York.

The Franciscans planted the Spanish vine at each mission on El Camino Real, and at most Spanish and Mexican haciendas. The Vina Madre of the Mission grape has flourished at Mission San Gabriel since 1775, and is still an enormous producer. The padres made their wine, not only for sacramental purposes, but for trading with the early sailing clippers. Dana mentions this in his "Two Years Before the Mast".

The selection of the specific grape best suited to a particular plot of ground or hillside was required, in France, centuries of experimental selection. It is therefore unfair to compare young California vines, none of which have been grafted more than seventy years, with those of Europe. California has made greater strides in the past ten years than ever before in varietal perfection.

As an industry in California, wine producing has an impressive position. It ranks first in capital investment of horticulture crops . . . followed by citrus and deciduous fruits and nuts. Its position is third in agriculture, surpassed first by cotton and secondly, livestock. The average annual retail return to the industry is \$555,000,000.00. Vineyards and winery property are valued at \$623,000,000.00. Year-round and seasonal employment to approximately 111,000 persons and annual wages totaling \$157,000,000.00. Ninety percent of the domestic wine of the United States is produced in California. California also supplies the nation with one hundred percent of the raisins used, and ninety-five percent of the table grapes.

The Wine Institute and the University of California, with the sympathetic attention of the consumers, are encouraging the vintners in efforts to improve the quality of their wines . . . and these efforts are succeeding!

Some of the successful vintners of the early days were Leland Stanford, Charles Wente, the father of Herman Wente, General Hearst, James Fair, Concannon of Livermore Valley fame and Lucky Baldwin.

Southern California Horticultural Institute

1961 PROGRAM

Program Chairman: Philip E. Chandler

- Jan. 12 "Chased by an Amoeba in Ecuador", Dr. Mildred Mathias
- Feb. 9 "Choice Winter-Flowering Plants", Mrs. Mildred Davis
- March 9 "California Native Plants", Percy Everett. Emphasis on those subjects adaptable to gardens with summer watering.

- April 13 "History of Horticulture in Southern California", Victoria Padilla. Honoring the publication of the book by the same name, written by Miss Padilla.
- May 11 Open
- June 8 "Trees for Streets and Public Grounds", Fred Roewekamp.
- July 13 "Use of Ornamental Plants in the Landscape", Philip E. Chandler. Panel discussion, including Scott Wilson, Mrs. Mildred Davis and Elmer Lorenz.
- Aug. 10 "Bear Country" and "Nature's Half Acre". Two short films on conservation theme.
- Oct. 12 Open
- Sept. 14 "Propagation". Emphasis on new methods and materials.

BOOK REVIEW

Southern California Gardens, An Illustrated History by Victoria Padilla. 168 illustrations, 16 in full color; 2 maps. Price, cloth, \$10.00. The University of California Press, in cooperation with the Southern California Horticultural Institute, is pleased to announce the forthcoming publication (spring, 1961).

This magnificently illustrated book covers every phase of ornamental horticulture in southern California. The work gives an authentic, engaging account of the land and its flora, both native and naturalized, and of the men and women who devoted themselves to its cultivation. Beginning with the Spanish-Mexican period, *Southern California Gardens* tells the story of growth and growing in the region for more than six generations. The period covered extends from 1769, when the Franciscan fathers began plant their first mission garden at San Diego de Alcalá, until the present day.

Lives of the pioneer horticulturists form several of the most absorbing chapters in the book. These personalities include growers, nurserymen, landscapists, seedsmen, and florists—both professional and amateur—and include such outstanding figures as Ozro W. Childs, Joseph Sexton, Hugh Evans, Manfred Mayberg (to whom the book is dedicated), and a number of women of importance in gardening, hybridization, and special fields.

Numerous other topics are dealt with, among them: trees and palms, the culture of roses, the growing of cacti and other succulents, and the establishment of the great private estates, public gardens, and parks. The development of the flower seed industry and the cut-flower business will lend additional interest for those concerned with the commercial side of floriculture. A final section deals with major changes in garden design.

Reading notes and appendixes give valuable information on the economics of horticulture of Southern California and on the temperature and rainfall of the region. An abundance of pictures in color and in black and white makes this not only an exceptionally informative and entertaining history, but also a volume of singular beauty.

The author, Victoria Padilla, is a native Californian and a member of the English faculty of Los Angeles City College. By avocation she is a gardener and a lecturer on botany. She is co-founder and secretary of the International Bromeliad Society and edits the Society's bi-monthly *Bulletin*; she is also active in the Southern California Horticultural Institute, the Hollywood Garden Club, and other related societies.



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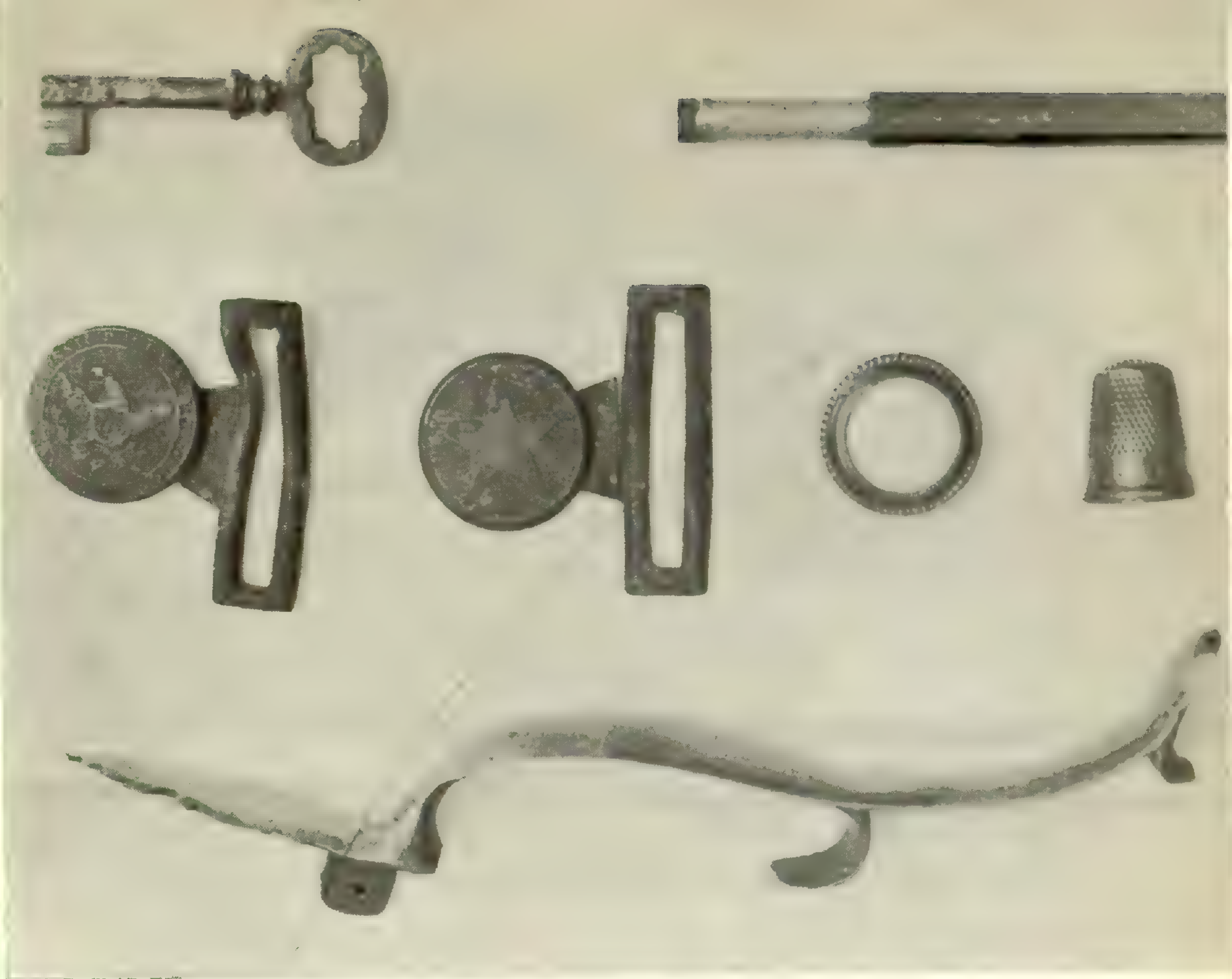
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to the

Dedication

of the

HUGO REID ADOBE

Los Angeles State and County Arboretum

301 N. Baldwin Avenue, Arcadia, California

on

"CINCO DE MAYO"

Friday, May 5, 1961 at 4:00 P.M.

HISTORY

The Furnishings of the Hugo Reid Adobe

GREGOR NORMAN-WILCOX

The story of the reconstructed Hugo Reid Adobe was told so well in the last issue of *Lasca Leaves*¹ that nothing of this shall be repeated here. Ours is the account of its furnishings, a project just now completed by the long-named Los Angeles-Pasadena Committee of The National Society of the Colonial Dames of America, Resident in California².

Something over a year has passed since our January 1960 report to the Colonial Dames, which offered a Furnishing Plan in full detail. This included a thumbnail history of the Rancho Santa Anita, biographical notes on Hugo Reid and his family, and discussion of policy matters, problems and puzzles.

Indeed, one wondered *how* in this rude, flat-roofed adobe of 1839/40 to satisfy the needs of Don Perfecto and Victoria with what was by then a piled-up collection of six youngsters! Besides Hugo Reid himself (aged 30 in 1840) and Victoria (aged 32) there were four children by her early marriage to Pablo Maria of the Yutucubits—stalwart boys Felipe and Jose Dolores, who were eighteen and sixteen; Maria Ygnacia, aged twelve; little Carlos who was four, and already two babies of Hugo Reid's. All these must be accommodated in a three-room dwelling, the frame ell of 1879 (built by "Lucky" Baldwin) being now removed, replaced by a *ramada* or arbor which was in effect an outdoor kitchen and eating room, with great beehive oven and adobe-built stove.

In this compressed area, what sort of living must be provided for? The family's town-house was of course Uva Espina, a two-story adobe built in 1838 nearby the San Gabriel Mission. Out at "the farm" (as the Santa Anita was called) Hugo Reid began in 1839 to establish orchards and vineyards, which so flourished that the family "soon found themselves spending more time [here] than in San Gabriel."³ Apparently, the boy Felipe remained at the *hacienda* as ranch manager, at least from his marriage in 1843 until the ranch was sold (in 1847, to Henry Dalton). We are told that at Santa Anita the family "lived in lavish *hacendado* style" but one wonders how, in these three small rooms plus the long porches and courtyard? True, contemporary accounts of feasting and celebration do not always make it plain whether the entertainments are held at Uva Espina, here on the Santa Anita, or at a third property La Huerta del Cuati (later called Lake Vineyard). The circumstances are puzzling. Was it here at the adobe that Jim McKinley and William Heath Davis sojourned in style "for nearly two months" in 1844?⁴—being daily "summoned by a maid to the *dining room* at noon" (where is such a room?) and finally taking their departure "from the gay ball." One is inclined to the opinion of Harry Sims Bent, that "clearly, only a vestige of the original establishment is standing," yet careful excavations did not produce evidence of anything more than the existing three-room house.

At any rate, the uses that must be assigned to these three rooms were easily enough determined. The middle and largest room, entered by doorways from both the road and

¹Susanna Bryant Dakin, "The Restoration at Rancho Santa Anita," pp. 15-21 in *Lasca Leaves* for Winter 1961, Vol. XI No. 1. Earlier accounts were in the issues for Summer 1951, Spring 1957, Winter 1959.

²We were privileged to work with three delightful ladies called the Historical Committee, these being Mrs. Paul B. Hammond (chairman), Mrs. John R. Mage, and Mrs. William B. Munro.

³Susanna Bryant Dakin, *A Scotch Paisano* (University of California Press, Berkeley, 1939), pg. 70.

⁴*Ibid.*, pp. 70-73.

courtyard, was a *sala* or family room. More privately situated, the south room (with access only from the *sala*) was an *alcoba* or bedroom. The north room served for storage and as a workroom, having a doorway out to the *ramada*. Here must be dishware and food stores; strings of peppers and bunches of candles would hang from the rafters; the two older boys would sleep here, on rough bedframes stretched with cowhide.

The rude materials and coarse finish of the house itself follow the local building conventions of that time; though larger, Don Abel Stearns' "palace" in Los Angeles was probably no better. The cool, dark rooms have packed earth floors and exposed adobe walls, beamed ceilings laid with tules lashed with rawhide thongs, and wood-barred windows which (something of a luxury) show casements fitted with glass. In lieu of fireplaces, each room has its open charcoal-burning *brasero*. Comforts are few, but few were expected.

Nothing of the original furnishings having survived, it was necessary to compile an inventory to fit the taste and needs of this large family, in its particular way of living. What things were available in the trade here at that time, and what would a man like Hugo Reid be likely to select? What would he bring home from his extensive travels in the 1840s? This picturesque Scot was well educated, a man of taste, a citizen of consequence. Neither he nor Victoria were in a position to inherit older things; what they had in 1840 was of that time, and certainly an oddly mixed lot!

The local flavor is established by a long series of very plain country-Mexican pieces, mostly of unpainted and weathered wood—sturdily joined chairs, stools and benches, a small chest of three drawers with looped leather thongs for pulls. A tall cabinet in the workroom was ranch-made near Fresno. Turned upside down, a small tree or three-branched bough was a readymade stool or table. A crucifix of Mexican straw-work hangs at the bedside, and from the Indian *santeros* of New Mexico come a little *bulto* of St. Joseph and a carved Virgin in a glass-doored shrine case. Indian work is seen in useful baskets, burnt pottery storage jars, a fine collection of blankets, and several stone mortars and *metates*, the finest one a black stone corn-grinder and *mano* used by the Gabrielino Indians on the Dominguez Rancho.

Especially admired at the time was English trade material—such as the handsome carcel lamp on Don Perfecto's reading table, or the Paisley shawls from his home country, some Bristol glassware and Staffordshire pottery. New England trading vessels would have brought Hugo Reid's delight, the fine Empire secretary with cabinet space for his books, and two looking glasses for the bedroom, a sewing table for Victoria, an assortment of the newest fluid lamps and peg-lamps.

Several pieces have interesting associations. We acquired Reid's spindled armchair, which came from the de la Guerra family; or the great canopy bed (dressed in a red-ground chintz of the period) that was made for Captain Gumisindo Flores of Monterey and Santa Barbara, married in 1834 to Cipriana Llanos; or a porcelain toilet service in rich blue and lavish gold, used by the del Valle family at Rancho Camulos.

But the oddest mixture of things came from Hugo Reid's wandering years, after he bought the 92-ton schooner *Esmeralda*. Sailing in 1841-42 down the Mexican coast, he might have brought back the two *alpujarra* rugs, the red-painted chest with bright Mexican peasant decorations, the Mexican folk pottery and glassware. He would have delighted Victoria with the beautiful silk-embroidered shawl, a sort called Spanish shawls though of course they were made by Chinese in the Philippines (then an outpost of Spain, and this shawl indeed found in Tarragona, Spain). A large *tapa* cloth and three exotic shells would be souvenirs of Don Perfecto's 1842 voyage to Honolulu and the South Seas. Next year he again covered the California coast from San Diego to Monterey, and how useful he would have found the fine two-part "boarding chest" now



The interior of the Reid Adobe has been furnished as of the Reid period; however, all the original furnishings have vanished. The master bed, the trundle bed, the fur pelt rugs, the bed warmer and the wardrobe with the mirrored door suggest elegance with simplicity so typical of early California pioneers. Photo: M. Richard Marx. Copyright 1961 Automobile Club of Southern California.

in his *sala* (a type so-called because these compact pieces were designed to be taken on shipboard).

In 1843-44 a trade voyage to China might have produced several things now seen in the Adobe—a black-and-gold lacquered tripod table, a fine tea-chest of the same work, a delicately pierced brisé fan for Victoria. The secretary desk chair of reed and rattan lacework is a type long made at Canton, the only Chinese port then open to “foreign barbarians.” And in the bedroom are two of those painted chests or *baules* so popular here in the early days. Chinese-made camphorwood chests covered with leather, sold in graduated nests that were painted red or green, brown, blue or black, with flowered borders and brass-nail trim. On their outbound voyage, American ships stopped here for hides or “leather dollars” used to cover these chests.

In all, here at the ranch was enough comfort for extended visits, if not the luxuries of Uva Espina. Only the bedroom has window curtains, of plain homespun; two fur pelts

serve as bedroom rugs; except for one wardrobe with mirrored door, chests and iron wall-pegs would do. First thought has been given to utility and convenience, not to "decorating" the rooms. Maria Ygnacia's doll is carelessly left on her bed, or Felipe's guitar on the couch in the *sala*. A trundle bed, a basketry cradle and a droll little high-



In a corner of the bedroom, one sees a low chest of drawers, a basketry cradle, two painted chests or *baules* Chinese-made camphorwood covered with leather. Put away in haste, the corner of a silk-embroidered shawl may be seen under the lid of the upper chest. Photo: M. Richard Marx. Copyright 1961 Automobile Club of Southern California.

chair suggest the presence of smallfry. Here are Victoria's shell comb and mantilla, or there Hugo Reid's beloved books and ledgers; by the boys' beds are wall-pegs for their *serapes* and a lariat, a rifle and powder horn, even a sabre.

To satisfy our strangely mixed list of requirements, material was acquired in several ways. Many things were purchased, from a fund raised for the purpose, others were heirlooms inherited by Colonial Dames members, still others were presented by private collectors and friends who became interested in the project and graciously offered their support. The transfer of a long list of items was had from Los Angeles County Museum. And in a few cases where reproductions must suffice (e.g., the pair of bedframes for the boys, or leather curtains to close doorways between the rooms) we were indebted to the skills of State of California workmen.

In the roster of historic house museums, which everywhere are coming to serve so important a role in our national life, the Hugo Reid Adobe will now occupy a distinctive place. Architecturally, it stands almost alone as an example of housebuilding tradition in the Los Angeles area of its time. And one would look far to find such colorful figures as the *Scotch Paisano* and his gracious Indian wife, who lived here in perhaps the most stirring and eventful decade of California's history.

Curator, Decorative Arts
Los Angeles County Museum

The Editorial Committee of *Lasca Leaves* wishes to express its thanks to the Automobile Club of Southern California for the courtesy of releasing the photographs used in the Reid Adobe article by Mr. Norman-Wilcox. The Editor wishes to thank Miss Patrice Manahan, Editor, *Westways* for arranging the loan of the photographs.

Arboretum Library

RUSSELLA MCGAH

Can any reader give us a source for the following publications?

- Allen: NEW ZEALAND TREES AND SHRUBS
- Bentham and Muller: FLORA AUSTRALIENSIS
- Blair: PRACTICAL TREE SURGERY
- Bucholz and Gray: TAXONOMIC REVISION OF PODOCARPUS
- Burrett, M.: MYRTACEENSTUDIEN 2 vols.
- Dahlgreen: INDEX OF AMERICAN PALMS. Field Museum, Chicago. Botany XIV
- Dykes: HANDBOOK ON IRIS
- JOURNAL OF THE ROYAL SOCIETY OF NEW SOUTH WALES Volume 44, 1910
- Kerr: PLANT PESTS OF THE WEST USDA 1952
- Laing and Blackwell: PLANTS OF NEW ZEALAND 3rd edition
- MacBride: FLORA OF PERU (Cycads) Field Museum, Chicago. Botany 13, Part 2,
nos. 1-3
- FLORA OF PERU (Rubiaceae) Field Museum, Chicago. Botany 13, Part 1,
nos 1-3
- Marloth: FLORA OF SOUTH AFRICA
- Martin: FLORA OF NEW ZEALAND
- Martius: FLORA BRASILIENSIS
- Merrill, E. D.: NEW OR NOTEWORTHY PHILIPPINE PLANTS. Parts 1-6
- Standley: FLORA OF COSTA RICA Part 4. Fieldiana, Chicago. Volume 18, Part 4
- Sweet: FLORA AUSTRALASIA

The library has need to borrow the following for photostating:
Martius: FLORA BRASILIENSIS Volume 15, part 2, 1870-76

_____ The portions on *Cassia* (with title page) pp 79-176

_____ The portions on *Bauhinia* (with title page) pp 179-212

If anyone knows where they may be available for such use we will appreciate being informed.

HORTICULTURE

Roses in Descanso Gardens

JOHN L. THRELKELD

If one genus of plant could be selected as the internationally favorite flower, it would undoubtedly be the rose. It is grown and esteemed in every state in the union and by nearly every nation in the world. It is grown as a garden shrub, as a garden specimen, as a vine, as a hot house plant, as a ground cover, as a plant for growing in hot spots, in cold spots, in wet conditions and in dry.

The use of the rose as a medicinal, edible and ornamental plant dates back as long as there has been mankind, and will undoubtedly be predominant in the gardens of man as long as he exists.

With a background such as this it is only fitting and proper that a special garden should be designed and grown to show the history of the most successful of all plants. One of the first organizations to undertake the momentous task of creating a history-of-the-rose garden was Descanso Gardens in La Canada, California.

Mr. E. Manchester Boddy, founder and developer of Descanso Gardens conceived the idea of bringing together in one collection as many of the roses as could be found which played an important role in the history and development of the modern rose. He commissioned Dr. Walter E. Lammerts, of world fame as a rosarian and hybridizer, to undertake the tremendous task of research necessary to initiate the development of a rose history garden.

The first plants began to arrive in the spring of 1948. Dr. Lammerts designed an area of approximately one half acre to include the historically prominent roses which were coming from all sections of the world. In 1950 the designated area was full to overflowing. By this time it became generally known among rosarians that such a project was underway and, as though by chain reaction, new information became available which resulted in a great many more species and varieties of roses becoming available than had been originally anticipated.

In order to adequately house the collection, Mr. Boddy directed the opening of an additional area to contain this now huge collection of roses. When the final installation was completed, the garden contained over six and one half acres with 350 species and varieties and over 8,000 plants.

Rose Species in the Descanso Collection

R. acicularis niponensis. This is an interesting rose from Japan having a pleasing light-colored foliage with single light-pink flowers. It is typical in characteristics to the wild rose.

R. andersonii. A very vigorous, fast-growing plant bearing 2-inch single pink flowers. An interesting wild-rose type.

R. anemoneflora (triphylla). This species is nearly evergreen and is an active climber. The leaflets are small, numbering 3 to 5. The flowers are white, fully double, the inner petals being shorter than the outer petals, about 1½ inches in diameter.

R. banksiae. One of the most rampant growers of all roses, this one has a semi-evergreen nature. The plant is practically pest-free, seldom being bothered by aphids or fungus diseases or other pests normally associated with roses. Flowers are white or yellow, borne in many-flowered umbels. The Descanso specimen has double flowers about one inch in diameter. There are also single flowers.

R. cantabrigiensis. This delicate, single, yellow rose, borne on tiny fern-like foliage, becomes a pleasing garden specimen as it ages. It somewhat resembles *R. hugonis*, but differs by having a larger flower and lighter green foliage.

R. centifolia. Commonly known as the Cabbage Rose, the centifolia is one of the oldest known roses cultivated. It was known to the Greeks and Romans before 270 B.C. The flowers are very double, pink, and possess a pleasing fragrance.

R. damascena. The Damask Rose is an ancestor of the Hybrid Perpetuals. It was brought to France by the Crusaders and thence to England. It is a native of China. The variety at Descanso has double-pink flowers borne in corymbs. There are also red and white forms and semi-double forms.

R. davidii. Closely related to *R. macrophylla*, differing only in limited botanical characteristics. The flowers are pink, single, about 1½ inches in diameter.

R. eglanteria. This is one of the most interesting of the species roses because of its foliage, which, when crushed, has a fragrance similar to an apple. The flowers are single, pink, 2 inches in diameter. It is commonly known as the Sweetbrier Rose.

R. forrestiana. This is an interesting rose with fern-like foliage and a moderately vigorous habit of growth. The flowers are rose-colored, double. The buds are slightly mossed.

R. gallica officinalis. "The Apothecary's Rose" or the "Double French Rose" was the first rose brought to the New World. It has gone wild in New England, growing in large creeping patches. The flower is 2 to 3 inches in diameter, deep pink to crimson.

R. gymnocarpa. This rose is native in the western United States. It grows, at maturity, about 10 feet in height. The flowers are pale pink, single, about 1 inch in diameter.

R. hugonis. Also known as "Father Hugo's Rose" or "Golden Rose of China". A native of central China, it is the first rose to bloom in spring. The flowers are 2 inches in diameter, yellow, borne singly all along the stem. The branches have a drooping habit as the plant ages.

R. laevigata. Also known as the Cherokee Rose, this is a very vigorous rose which will attain great height where it can cling to a supporting object. The flower is about 3 inches in diameter, fragrant, white. A pink form is also available. It is naturalized in the southeastern United States but is a native of central China.

R. longicuspis. The delightful single, light pink flowers, 2 inches in diameter, are borne in few-flowered corymbs on gracefully arching canes, making this species a valuable garden plant. It is easily identified by the ovate to ovate-oblong leaves, and the silky-textured flowers.

R. macounii. This is an interesting little rose bearing small, single, light-pink flowers. The foliage is small. It is native to the lower northwest portions of North America.

R. macrophylla. A very interesting plant with larger fern-like foliage. It has very few thorns, but those it has are extremely large. The flowers are single, light-pink to red at the outer edges of the petals. The buds are borne singly or in pairs and are slightly mossed.

R. macrophylla doncasterii. A beautiful plant the year round with its pink flowers, huge seed hips, thornless red canes and beautiful foliage. The flowers are single, rose red, about 2 inches in diameter.

R. moschata. This species is the forerunner of the Hybrid Musk Roses. It is an extremely profuse bloomer, possessing an intense musk fragrance. The flowers are about

1½ inches in diameter, borne usually in 7-flowered corymbs. The Musk Rose is native to southern Europe and north Africa, but has assumed a high degree of popularity wherever roses are grown.

R. moyesii. This is one of the most beautiful of all the species roses. A native of west China, it blooms abundantly in June and July. Perhaps the most interesting characteristic of this rose is its foliage. The leaves are compound, having as many as 15 leaflets. The canes are long and arching, and are especially valued by flower arrangers for filler material. The flowers are about 2 inches in diameter, deep blood red through deep rose to light pink.

R. mulliganii. A small-growing double white rose from western China. It has a pleasing fragrance.

R. nitida. This is a beautiful, compact, neat-appearing species which produces 2-inch double, light rose colored flowers which are borne singly or in few-flowered corymbs. It is a very pleasing plant.

R. sericea pteracantha. Also known as "Wingthorn and *R. omeiensis*", this rose is most noted for its huge translucent thorns and fern-like foliage. It is a native of west China. The flowers are white, usually with four petals, about 1 inch in diameter. A valuable garden plant.

R. pendulina pyrenaica. This is a small-growing plant bearing small, single, velvety red flowers.

R. reversa. This rose has an interesting mimosa-like foliage. Its stems are very densely covered with tiny red thorns. The flower is dark pink or light red, single, about 2 inches in diameter.

R. rocheii. This is a recently discovered species which is yet to be evaluated in Western gardens. Its growth habit is interesting although very irregular. It apparently resents heavy pruning, preferring to grow into a large, scraggly plant. The flower is single, scarlet colored, about 2 inches in diameter.

R. rubrifolia. Most valued for its unusual and artistic foliage, which is used in flower arrangements. The flowers are about 1½ inches in diameter, pink, and borne usually in three's. It is a native of the mountainous regions of China and southern Europe.

R. spinosissima. Commonly known as "Scotch Brier" or "Burnett Rose", this very spiny species has interesting yellow flowers which are single, about 2 inches in diameter and are borne singly along the arching spiny canes. White and pink forms are also known.

R. suffulta. A small-growing plant bearing 1 inch, single, pink flowers, this species is a native of North America.

R. sweginzowii. This is an interesting species bearing 1½ inch, rose-pink flowers borne singly or in few-flowered corymbs. The foliage is rough, somewhat resembling the rugosa foliage, but is generally more pointed and narrow.

R. villosa pomifera. One of the most vigorous of the species roses, growing to great size, the flowers are 2½ to 3 inches in diameter, semi-double, light pink. The buds are hispid. It is a native of western China and is a valued garden plant.

R. wichuraiana. A Rambler Rose from which many hybrids have originated. It is used for bank covering or ground cover. Nearly evergreen, it is native to East Asia. The flower is 1½ inches in diameter, white, and is borne in few-flowered pyramidal corymbs.

What a fascinating story these roses tell! Each individual species has a character and story all its own. It will not be the function of this work to enter extensively into the romantic background of this great plant family, as this information is available elsewhere. However, it must be said that no plant family has had a more fascinating or romantic history. The progress of the rose has paralleled the progress of mankind, experiencing all the great advancements and setbacks, flourishing during peaceful periods

when the interests of humanity turned to non-destructive pursuits and recessing during periods of conflict.

The first known varieties which were the fruits of the hand of man emerged with the dawn of modern Christian civilization. Those firstlings must have been highly esteemed by their developers and caretakers to have survived, or rather to have reached the stage of classic immortality which they enjoy today.

First Known Varieties—1500-1600

Austrian Copper, *Rosa foetida bicolor*. The brilliant copper-red or vermillion surface color of this rose and the bright golden-yellow color of the reverse of the petals combine to make this one of the brightest-colored roses of all time. The flower is about 2 inches in diameter, single and short-stemmed. The origin of this variety is unknown, however, its importance to rose breeding is not excelled by any other plant as it opened an entirely new vista in rose development of bright yellows and bicolors, when the French rose firm of Pernet-Ducher introduced the Austrian Brier characteristics into the Hybrid Tea class of rose in 1900.

Kazanlik, *R. damascena trigentipetala*. Most noted as the major source of Attar of Roses, this rose is one of the most fragrant ever grown. The flower is double, colored a bright rosy pink, about 2½ inches in diameter. It is thought to have originated in the early 1500's.

Mousseaux Anciens. A vigorous, hardy old Moss Rose, the flowers of which are very double, pink, shaded darker toward the center. The sepals are beautifully mossed. Its origin is lost in antiquity.

Old Pink Moss (Communis; Common Moss; Pink Moss). The actual origin of this rose is unknown, but it appeared in Holland about 1596 A.D. The buds are heavily mossed. The flowers are double, large, cup-shaped, pale rose colored. It has a delightful fragrance.

Rose of Castile (Damask Rose; Castilian). This rose is a form of *R. damascena* which was brought to the New World by the Spanish invaders of Mexico. It was spread throughout the Southwest by the Roman Catholic Priests who followed the invaders to spread their doctrine among the natives, and by the Mexican pioneers who moved from Mexico to California.

York and Lancaster, *R. damascena versicolor*. This rose was first noticed and propagated during the "War of the Roses" in the early 1500's. All students of the rose and/or history are familiar with the legend of this war, which was stopped when a rose blossomed forth with flowers showing both white (the color standard for the armies of York) and red (the color standard of the armies of Lancaster). The opposing sides took this variation in the rose color to be a sign from heaven to cease fighting and join together in a common bond.

This rose is frequently confused with the *Rosa mundi*, which did not appear until the middle 1600's.

It bears semi-double, fragrant flowers, some petals of which are white and some are red.

Rose Development—1600-1900

As time progressed through the 1600's and 1700's, such outstanding roses as *R. mundi* and *R. centifolia pomponia* (Pompon Rose) made their appearance.

Progress was still slow in the era of 1700-1800, but some roses were introduced in that time which have become classics and are still valued today by rose collectors. The old Blush Rose which Thomas Moore made immortal in this poem "The Last Rose of Summer", and the Tuscany Rose are typical of this era.

In the era from 1800 to 1850 rose breeding reached the peak of interest to that time. In fact, more outstanding roses were introduced in that span of 50 years than in all other eras combined to that period. It was as if Mother Nature had suddenly released her secrets, and rosarians began to bring forth many outstanding roses, some of which are still playing important roles in rose hybridizing.

Great progress was made in hybridizing the *R. gallica* species. Many gallica varieties were introduced, including the Grand Cramoisi, Fanny Bias, Cardinal de Richelieu, Neron and others. The Noisette roses and many other hybrids began to appear.

One of the outstanding classic roses of all time was introduced during this period, named *Rosa centifolia cristata*, Chapeau de Napoleon or Crested Moss. The sepals of this rose create an interesting crest or plume over the bud which would be attractive even on our own more modern roses.

The *R. damescena* or Damask Rose experienced great improvement with the introduction of the Mme. Hardy variety. This rose was sufficiently grown in commerce to gain fame as the Mother's Day Rose.

Of no less importance was the introduction of the Harison's Yellow Rose, a hybrid foetida, in 1830. This rose reached its peak of popularity in America in the middle 1800's to the early 1900's. The westward movement to Oregon and California caused the movement of this rose to the western states, where it has become naturalized in parts of Oregon and in the Mother Lode Section of California.

The dominant figure in horticulture during the early nineteenth century was the Empress Josephine, wife of Napoleon. Among other things, she busied herself with the direction of some of the most outstanding gardeners of France in breeding and introducing new varieties for her garden at Malmaison.

The tremendous hybridizing activity can be imagined upon realizing that over 30,000 varieties were introduced during this period. It is quite obvious that the Descanso collection can afford space for only the most outstanding varieties introduced during that era.

Even greater emphasis on rose breeding was to be experienced during the 25 year period from 1850 to 1875. Again, thousands of rose varieties were introduced.

In 1853 a gallica rose was named after Georges Vibert, who was for many years the head gardener at Malmaison for Empress Josephine. It was by his hand that many hundreds of new varieties were introduced. It is a fitting tribute that one of these outstanding seedlings should carry his name.

One of the greatest strides forward in the development of roses occurred in 1867 with the introduction of the first Hybrid Tea rose. The variety was called La France. The La France heralded the development of the modern spectacular roses which are universally grown today.

Among the other thousands of roses emerging during this period was the General Jacqueminot, Rev. d'Or, Paul Neyron, the Cherokee Rose (*R. laevigata*), and many Hybrid Perpetuals including Mme. Victor Verdier, Duke of Edinburgh and Prince Camille de Rohan.

Many roses developed during the period 1875 to 1900 are still to be found in commerce. Outstanding in this group is the Hybrid Tea, K. A. Viktoria, a very fine white double flower. The Hybrid Rugosa, Mrs. Anthony Waterer; the Hybrid Perpetuals, Ulrich Brunner and Magna Charta, are also to be found commercially grown.

In 1875 the world-renowned American Beauty Rose was introduced. Some florists sold red roses under the name of American Beauty in recent years, although the original variety has not been commercially produced for many years.

By 1900 interest in roses was world-wide. As better transportation and communication media became available, much exchange of skills and ideas took place. Although European gardeners held the reins on most horticultural development, American horti-

culturists began to make an imprint on the horticultural world. As early as 1930 to 1940 American horticulturists emerged as world leaders in plant development. The lead is undoubtedly maintained today.

Five Outstanding Special Effects Roses Grown in Descanso Gardens up to 1900 Era

R. centifolia parvifolia, Burgundian Rose. The small red flowers are about the same size and color as red clover. It blooms in large quantities on low creeping stems which reach a maximum height of 20 inches. It will form a low, impenetrable border or hedge.

Previously described: Crested Moss, Chapeau de Napoleon; *R. centifolia cristata*. *R. banksiae*. *R. laevigata* (Cherokee Rose). *R. macrophylla doncasterii*.

Ten Most Outstanding Roses in Descanso Gardens up to 1900 Era

Delicata (Hybrid *Rugosa*). This rose has the typical *rugosa* foliage as well as the densely thorny characteristic of that species. Its color is a delicate orchid pink. It produces flowers intermittently throughout the growing season. The flowers are sufficiently unusual to confound many people who are not botanically trained into thinking it is a flower other than a rose. The growth of the plant is not particularly vigorous but it is a persistent grower.

Previously described: Austrian Copper, *Rosa foetida bicolor*. Crested Moss, Chapeau de Napoleon; *R. centifolia cristata*. Harison's Yellow (Probably *R. foetida persiana* X *R. spinosissima*; *R. centifolia muscosa* (Moss Rose; old Moss; old Pink Moss and numerous other names). *R. centifolia parvifolia* (Burgundian Rose). *R. macrophylla doncasterii*. *R. moschata*. *R. moyesii*. *R. rubrifolia*.

Rose Development—1900-1940

Rose hybridists were working at a fevered pitch during the era from 1900 to 1940. There was a tendency toward intense hybridization and inbreeding, which tended to produce many weak varieties unfit for prolonged culture. There were also developments which lead to exciting new discoveries in rose breeding.

Most studnts of the rose will remember the romantic story of the development of the *Soleil d'Or* Rose which was the beginning of the modern day yellow rose line. The *Soleil d'Or* was actually a dream come true.

Marie Pernet-Ducher had a dream which instructed her of a cross to make between the Hybrid Perpetual *Antoine Ducher* and the Persian Yellow rose. After many failures to make this cross, Madame Ducher finally succeeded in raising one seed to blooming size, which was named *Soleil d'Or*. The introduction of this rose lead to the development of most of the deep golden-yellow, golden-orange and coral colored roses recently hybridized.

In 1918 the hybrid *bracteata* variety "Mermaid" was introduced. It has since been acclaimed one of the finest bank covers or spreading roses in use in mild climates. In fact, it will grow under natural conditions in most parts of southern California's habitable regions.

The ever-popular Hybrid Perpetual 'Frau Karl Druschki' was introduced in the early 1900's. The classic variety, 'Dainty Bess', was first marketed in 1925.

In 1930 the United States Plant Patent Law went into effect. Rose breeders were to profit more from this law than any other legislation relative to horticulture. Its initiation transformed rose breeding and growing from an amateur or low-income commercial standard into the area of big business. It also placed American horticulturists far out in front, as the leading rose developers of the world.

To be continued

SLOW-BURNING PLANT RESEARCH PROGRAM

Los Angeles County Department of Arboreta and Botanic Gardens

F. T. CHING

- I. FIRE TUNNEL TESTS
 - A. Malibu
 - B. Lux Arboretum Annex
 - C. Descanso Gardens
- II. DESCANSO
 - A. Seed Plots
 - B. Large Test Plots
- III. LARGE TEST PLOTS
 - A. 7 Species of Plants
 - B. 14 Plots
- IV. OBSERVATIONS OF ESTABLISHED PLANTINGS
 - A. Growth Performance and Characteristics
 - B. Regeneration
- V. SEED COLLECTING
- VI. EFFECTS OF HERBICIDAL SPRAYS
- VII. MAP AND CARD FILE INDEX OF ALL PLOTS

LARGE TEST PLOTS

Forest and the San Bernardino National Forest have cooperated in setting up test plots of plants. During the past years, the Los Angeles State and County Arboretum, the Angeles National Forest and the San Bernardino National Forest have cooperated in setting up test plots of plants varied and are listed as follows:

1. Single plants—for observations of growth characteristics
2. 25 sq. ft. seed plots—for germination observations
3. 16' x 5' transplanted plots—for fire tunnel tests
4. Roadside plantings—for field plot observations, seed source and erosion control.
5. Flood Control dams—for field plot observations, seed source and erosion control.
6. 30' x 40' transplanted plots—for open burning tests
7. One three-acre plot—for open burning tests

At the present time, we feel that we have sufficient number of diversified type of plots and that we should establish a more basic type of plot that would serve several purposes such as:

1. Survival of transplants
2. Seed germination and survival
3. Eventual open burning tests
4. Uniformity

These large plots will be established in as many different locations as possible and three of these plots have already been established. The design for these plots are as follows:

- A. Plot Design
 1. 200' x 200'
 2. Transplants at 10' intervals
 3. Approximately 400 plants per plot
 4. Seed the same area at rate of 10-40 seeds per sq. ft.
- B. Plants

1. *Cistus purpureus*
2. *Cistus ladaniferus*
3. *Eriodictyon trichocalyx*
4. *Atriplex halimus*
5. *Atriplex canescens*
6. *Atriplex Breweri*
7. *Helianthemum nummularium* var. *mutabile*

- C. Location
 1. Coastal
 2. Inland at varying elevations
- D. Cooperative—a majority of these plots will be established as a cooperative project with the Angeles National Forest

Plant Research Assistant
 Los Angeles State and County Arboretum
 January 1, 1961

Historic Objects from the Hugo Reid Adobe

WILLIAM J. WALLACE AND E. S. TAYLOR

Introduction

In November, 1956 a group of archaeologists from the University of Southern California and Archaeological Research Associates organization, at the request of the State of California Division of Beaches and Parks, set to work exploring the Hugo Reid Adobe. The immediate purpose of their investigation, which was to continue until late May, 1958, was to search for architectural remains from which information could be obtained for an authentic restoration of the historic house. This objective was attained when adobe-brick footings and earthen floors of the original three-room residence, built by Hugo Reid in 1840 to serve as headquarters for his three-square-league Santa Anita land grant, and remnants of walls of a later adobe wing were unearthed (Wallace, Desautels and Kritzman, 1958).

But an archaeologist's job is not completed when he locates and exposes a buried foundation or lays bare with trowel and brush the floor plan of a demolished building. His broader aim, and the ultimate purpose of all his digging and searching, is historical. He seeks to extract from his findings clues as to the general course of human events that took place at a particular prehistoric or historic site and to reconstruct, as far as his discoveries permit, the manner of living of its former inhabitants. Until this is done his work is not finished.

No less important than the physical remains of a house or other building in achieving this end are the man-made objects brought to light during excavation. Such finds not only assist in interpreting structural features with which they are associated but they also afford insight into the daily life and activities of their users. Because of their importance, a diligent watch was kept for any artifacts which might be turned up while digging was in progress at the Reid Adobe. All articles unearthed, ordinary and unusual, whole and fragmentary, were saved. After being cleaned and numbered in the laboratory, they were classified as to material and function, measured and described.

Description of Artifacts¹

In the main, the historic objects recovered were commonplace articles of every day use, discarded because they had become worn out or had been broken. Only rarely was a whole and serviceable artifact retrieved, and then it was something small which had been lost. The majority of finds came from household refuse beneath modern wooden flooring in the various rooms. This loose, black deposit, resting upon an older hard-packed clay floor, reached an average thickness of 18 to 24 inches. It contained quantities of building materials and food remains as well as artifacts. A smaller number of articles were found in trenches excavated parallel to the outside walls of the dwelling. Digging in the "patio," (west of the original Reid residence) produced only a minor collection (Wallace and Taylor, 1959). A fair-sized lot was found during restoration work.

¹Many persons have contributed to the completion of this report. Members of the Archaeological Research Associates organization assisted in the preliminary sorting and tabulating of artifacts. Expert help in identifying objects was given by Russell Belous, Eugene and Stefania Holt and Gregor Norman-Wilcox of the Los Angeles County Museum staff; Arthur Woodward, formerly of the Museum staff; officers Vincent Ryan and William Lee of the Los Angeles Police Department; Janet Stevenson, Historical Research Librarian of the International Silver Company; Alan R. Quinby of the Diamond National Corporation; A. Forthmann, President of the Los Angeles Soap Company; Hal Hinkson of the California Hardware Company; J. T. Dale, President, Consolidated-Dougherty Card Company; and John Hussey, Historian, National Park Service.

Because the soil, even beneath the wooden flooring, was damp, conditions were not favorable for preserving items made from perishable materials such as paper, wood, or cloth. With few exceptions, therefore, the objects recovered are fashioned from metal, glass and ceramics, substances which are durable enough to have survived the passage of time and the forces of decay.

Household furnishings. When archaeological work began, none of the house's furnishings remained as all pieces had been moved out long before. The few surviving fragments were:

1. A leg or support for a small cast-iron stove or andiron. It is 5 inches high and $\frac{1}{2}$ inch thick, with a decorated base.
2. A thicker, solid piece of cast iron may also be a section of a stove.
3. An angled length of cast-iron appears to be part of the side element of a metal bed frame.
4. A scrap ($1\frac{3}{4} \times 2\frac{1}{2}$ inches) of what seems to be twilled-weave upholstery cloth. It is thick and discolored. Two rust stains from upholstery tacks are visible.
5. Another cloth fragment, badly stained, may be a remnant of a window drape. It has thick cotton warps and thinner wefts of another, unidentified fiber. Two edges are hand-hemmed.

Several examples of furniture hardware were excavated. Included were:

1. A brass and ceramic drawer handle or pull (Plate 1 Cover). The item has a white porcelain center with a brass rim and backing. It measures one inch across.
2. A small, decorative brass knob. It has a maximum diameter of $\frac{5}{16}$ of an inch.
3. The brass, pyramidal-shaped head of a fancy upholstery stud of a type formerly used on leather chairs or sofas. It measures $\frac{1}{2}$ inch across its base.
4. A well-made brass key for desk or chest. The ornamental stud (Plate 1) has a hollow body and two prongs. It is $2\frac{1}{2}$ inches long.
5. A dead bolt, the sliding part of a lock operated with a key. The object consists of a rectangular bolthead made from a good grade of brass at one end and a thin, rusted iron shaft at the other. It is of a size used to lock the hinged lid or drawer of a desk or cabinet. The brass portion measures $\frac{1}{2} \times 1$ inch and is $\frac{3}{8}$ of an inch thick; the iron piece is 3 inches long and less than $\frac{1}{8}$ inch thick.

The only scraps of floor covering are four fragments of a cheap grade of linoleum. The pieces are all small, averaging $1 \times 1\frac{1}{2}$ inches. The background color is light, originally tan or white. Decoration consists of floral designs, now of a faded brown color.

A small, rusted cast-iron "screw pulley," $4\frac{1}{4}$ inches long, was unearthed inside one of the rooms (Plate 4). Its wheel has a diameter of only $1\frac{1}{2}$ inches and a groove designed to hold a $\frac{1}{4}$ inch thick cord. The base is pointed and threaded for screwing into a wall or ceiling. The pulley is of the kind used for operating bamboo shades, wooden shutters, and the like.

Lighting devices are represented by kerosene lamp parts, a broken light fixture and electric light bulbs. The following were found:

1. A burner from a large kerosene lamp. The object is of brass and has a diameter of $3\frac{1}{4}$ inches. It is unusual in having slots for two wicks.
2. Five pieces of glass lamp chimneys. Three are scalloped-edge fragments.
3. A brass holder for a light fixture. Three brass screws still hold in place part of the base of a milky-white, hob-nailed, glass globe. The holder has a diameter of $2\frac{1}{2}$ inches. Perhaps this is part of a porch-light or other outdoor fixture.
4. Seventeen pieces of milky-white glass, apparently from similar light fixtures. Ten are smooth-surfaced; the remainder have hob-nails.
5. An intact light bulb and parts of three others. The former is an old-fashioned, burned-out, low-wattage bulb. Metal bases and a glass filament of two other small electric light bulbs as well as a third glass filament, were also obtained.
6. Twelve pieces of thin, curved glass, undoubtedly, are fragments of light bulbs.

Decorative objects for the home comprised a portion of a plate and a broken figurine. A rim section of a thick ($\frac{5}{8}$ of an inch), shallow, earthenware dish was found. It may be a piece from a large fruit dish or from a receptacle placed beneath a flower pot. The sherd is gray-glazed and with brown mottling on its upper surface. The ceramic figurine may once have adorned a mantel or table. It represents a girl wearing a voluminous pink dress with overlapping yellow and purple aprons. The portion above the waist is missing. The remaining piece is only $1\frac{1}{2}$ inches high.



Plate 2: Tableware. The tablespoon at the right is unusual in being made of britannia, an alloy resembling pewter in appearance.

The surviving traces of house furnishings indicate that they were neither elaborate nor expensive.

Tableware. A large assortment of articles used at the table were unearthed. Broken crockery was particularly plentiful. It consists primarily of a heavy, inexpensive class of white earthenware known as "ironstone." Most pieces are undecorated; ornamentation where it occurs (7 examples) is by scalloping of borders, paneling of sides or appliqueing so as to produce a raised pattern. Nearly 60 percent of the sherds are "crazed"—networks of tiny lines running across their surfaces. Weathering could have played a part in bringing about this condition but it could also have resulted from either uneven thermal expansion of the glaze or improper firing.

No whole or even nearly complete ironstone articles were found but some pieces could be fitted together to form partial vessels or larger sherds. From these, and bigger fragments, it was possible to determine shapes. Represented were:

1. Dinner plates, assorted sizes—65 fragments
2. Bowls; small, fairly deep; also broad but shallow—20 fragments
3. Cups—34 fragments
4. Saucers—11 fragments
5. Serving bowls, oval—2 fragments
6. Serving platters, oval and circular—7 fragments
7. Butter dishes—2 fragments
8. Trivet—1 fragment
9. Chamber pots (or wash basins)—3 fragments
10. Unidentifiable—57 fragments

Eight ironstone sherds bear a manufacturer's mark, five of which were identifiable (Thorn, 1947; Kovel, 1953).

1. Goodwin Brothers, Liverpool, Ohio, 1844-53
2. Alfred Meakin, England, established 1881
3. Pioneer Pottery Company, Wellsville, Ohio, 1885-96
4. J. G. Meakin, England, established 1891
5. Moddock and Co., England, possibly post—1911.

Not recognizable were three partial monograms—2 impressed and one painted.

Included in the collection are 46 fragments of white porcelain or chinaware. The sherds are all thin-walled, averaging less than $\frac{1}{8}$ th of an inch. Shapes included:

1. Dinner plates—11 fragments
2. Cups—7 fragments
3. Saucers—6 fragments
4. Serving platters, oval—3 fragments
5. Unidentified—19 fragments

At least two pieces are definitely French Haviland ware as they bear part of the manufacturer's green pigmented mark, (Kovel, 1953 p. 60). "H & C"/depose. This ware dates from about 1887.

Only a small percentage (ca. 8 percent) of the ceramic material bears painted designs. Decorated sherds consisted of:

1. Staffordshire ware. Included here are 14 earthenware fragments of the type manufactured in England by Staffordshire potters. The sherds have a whitish background with design elements in blue (8), purple or purplish-red (2), black (1), brown (1), red (1), and polychrome (1). It is a cheap and plentiful crockery, imported into the United States in great quantities.
2. Spode ware. The basal fragments of a plate bears the blue mark, "Copeland and Garrett Late Spode." The piece has a blue floral design on a white background. This sherd is of particular interest because it represents a variety of pottery made only during a short span of time, between 1833 and 1847 (Kovel 1953, p. 174).
3. Salt glaze. Two small gray sherds bearing a black design have been identified as "salt-glazed" ware.
4. Chinese porcelain. These six sherds, of a common export type, have a gray background and blue designs.
5. Hand-painted porcelain. This thin, white chinaware piece has a hand-painted floral design in blue and green.

Glassware for the table was either not too abundant or went unrecognized among the hundreds of glass fragments uncovered. There are six pieces of wine glasses or goblets, none of which bears a maker's seal or other distinctive marking.

1. Two pieces are from a thick-walled, stemmed goblet. Included are the bowl with a short section of stem and the entire circular base. The goblet was large, with a top diameter of four inches.
2. A smaller, thinner goblet is represented by a basal fragment with a bit of stem attached.
3. A third goblet of very thin glass has a hollow stem.
4. Two clear, curved pieces of glass may also be from goblets.

A few pieces (6) of thicker-walled drinking glasses were also obtained.

Other glassware used at mealtime included:

1. Part of the neck and top of a cruet or small glass bottle for vinegar, or oil.
2. Three fragments of decorated clear glass, probably from a serving bowl.

Eating utensils are represented by three spoons, all more or less intact; three forks one nearly whole and the others fragmentary; and an entire table-knife (Plate 2).

1. A dull-surfaced tablespoon is made of britannia metal, an alloy (chiefly tin, antimony and copper) which resembles pewter. It is a mold-made variety, manufactured up to the 1830's and 40's. The bowl is much worn.
2. A silver-plated tablespoon. Its pattern is the Oval or Oval Thread design which was first made in 1855. The "Rogers Bros. 1847" trade mark on its reverse side did not appear, however, until 1871. At this time the Rogers 1847 brand was made in three different qualities. The qualifying mark "A1" on the specimen denotes that this was the least expensive of the three. Tablespoons in this quality sold for \$7.50 per dozen.
3. A silver-plated teaspoon. This bears the Threaded design first made in 1847; its Rogers Bros. trade mark is eroded. Apparently of the same quality as the above tablespoon, this type of teaspoon was priced at \$3.50 per dozen.
4. A wooden-handled, three-tined steel fork, of an inexpensive type, possesses no distinguishing markings. This is of such a generalized form that it cannot be dated with certainty; it could be an early type.

6. A single table knife, though corroded, is in good condition. It is a plain, solid-metal-handled, steel knife. Sometimes these knives had silver-plated handles and sometimes they were plated all over. It belongs in the same time period as the Rogers Bros. spoons.

Two hollow bone handles, one intact and the other broken, were found. A burned section of a third, similar specimen contains a short length of metal, and seems to be the remains of a fork.

Kitchen accessories. Pots, pans, kettles and other kitchen ware such as cleavers, carving knives, ladles and the like were conspicuous by their absence. Either these articles, when no longer serviceable were disposed of in trash pits some distance from the house or they have disintegrated into indistinguishable metal scraps.

Approximately one-half of a stone hone was found. It is quite small, being $1\frac{1}{4}$ inches wide and $\frac{5}{16}$ of an inch thick. The hone shows evidence of considerable use on both surfaces.

A small, miscellaneous group of earthenware sherds are from vessels suitable for the storage of foodstuffs. There were:

1. Nine sherds of brown-glazed ware. These seem to be from a single vessel like a bean pot.
2. Five dark-green, tin-glazed sherds are parts of a wide-mouthed jar of recent Mexican manufacture. The vessel's walls were thin and easily fractured.
3. Two, off-white, thick sherds apparently are from a crock. The two pieces are curved and fit together. Their surfaces are slightly pitted.

A portion of a paper soap wrapper, with red and black printing, reads "Pride of German Family." This product, a laundry soap, was manufactured by the Los Angeles Soap Company between 1894 and 1917. The trade name was dropped at the beginning of World War I.

Clothing. It is uncertain as to exactly what forms of clothing were worn as no whole garments or large pieces thereof were recovered. The remnants of wearing apparel which have survived suggest that the former inhabitants were regularly dressed in hard-wearing, rough clothes suitable for ranch-work and living. Their wardrobes probably also contained better garments for special occasions and Sunday-wear.

A few scraps of clothing have been fortuitiously preserved by rodents carrying them into their burrows beneath the rooms. Although the bits of fabric had been well-chewed they were not otherwise badly disintegrated. Retrieved were:

1. A 5 x 8 inch section of loosely knit white cotton cloth. This is probably part of a man's suit of underwear.
2. Four fragments of black cotton knit stockings. Included are a tubular upper piece and part of a heel.
3. A discolored scrap ($\frac{3}{4}$ x $3\frac{1}{4}$ inches) of white or tan cotton cloth. The fragment is tightly woven and of garment quality. It offers no clues as to the form of clothing from which it came.
4. A 2 x $2\frac{1}{2}$ inch piece of finely woven black silk. It is machine sewn and may be a remnant of a coat lining.
5. A tightly woven, $\frac{3}{4}$ inch wide, strip of stained cotton cloth. This also may be part of a coat lining though it could have been torn from a blouse or dress. The piece is shiny and smooth on one surface and dull and rough-textured on the other.
6. A knitted ring, $3\frac{3}{4}$ inches in diameter, of brown cotton thread with a shred of cotton cloth adhering to it. This appears to be all that remains of a buttonhole.

An excellent assortment of buttons of various sizes and materials was obtained (Plate 3). Mother-of-pearl buttons (Plate 3, top row), 34 of which were found, form the most numerous and varied group. Their diversity is understandable as some of these "pearl" buttons were ornamental. Five forms are recognizable.

1. Clip button (1). This button was attached to a garment by means of a brass clip. It is medium-sized² with a $\frac{3}{4}$ inch diameter.

²Standardized button sizes are: diminutive under $\frac{3}{8}$ inch; small $\frac{3}{8}$ - $\frac{3}{4}$ inch; medium $\frac{3}{4}$ - $1\frac{1}{4}$ inches; large over $1\frac{1}{4}$ inches (Albert and Adams 1951, pp. 172-3.)

2. Shank button (1). This specimen is provided with a metal shank or loop for attachment. It is small, measuring $\frac{1}{2}$ inch across.
3. Two-hole (10). Mother-of-pearl buttons with two perforations for sewing to fabric were fairly abundant, with ten examples obtained. Three, one of which is grayish-tan in color, are decorated on their outer surfaces with three raised, concentric circles. They are "shirtwaist" buttons and could have been sewn to shirts or underwear. All are small, ranging in diameter from $\frac{3}{8}$ to nearly $\frac{3}{4}$ of an inch, with an average about $\frac{7}{16}$.
4. Three-hole (1). A single three-holed button is ornamented with an encircling groove near its border. It is a decorative, diminutive button measuring slightly less than $\frac{3}{8}$ of an inch across, and could have been a glove button.
5. Four-hole (21). Most numerous of the "pearl" buttons are those with four perforations, and 21 examples were found. Only one of these buttons is decorated. They are either small (14) or diminutive (7) with the largest specimen having a diameter only slightly exceeding $\frac{5}{8}$ of an inch. The seven diminutive buttons probably are decorative and could have come from men or women's gloves, or could have served to button down the wings of men's collars. The others are of the "shirtwaist" variety.

White porcelain buttons make up the second most numerous category with 25 examples retrieved (Plate 3, second row). They are of a common utility type and only two forms are represented.

1. Three-hole (3). The three-holed porcelain buttons are all diminutive. Their tiny size again suggests a decorative use.
2. Four-hole (22). The remaining 22 porcelain buttons all have four perforations. Except for three, they are small, with $\frac{3}{8}$ to $\frac{9}{16}$ inch diameters. Mainly they are underwear buttons. One button is decorated with eight parallel lines of tiny punctations. The three diminutive specimens are unornamented.

Metal buttons were not particularly abundant. The 18 collected form a varied group (Plate 3, fourth row).

1. Shank buttons (2). These two specimens are brass, two-piece buttons, the metal front and back clamped together. The first, of military style, bears an eagle on its outer convex surface and may be from an army uniform. It has a diameter of $\frac{3}{4}$ inch. The second larger "ball" button is nearly spherical. No decoration is visible on its surface. Its size suggests that it is from a heavy garment, perhaps an overcoat.
2. Two-hole (1). A plain brass button has two perforations. It is small, measuring about $\frac{1}{2}$ inch across. This is probably an overall or work trouser button.
3. Four-hole (5). Four buttons included here are made of iron, all badly rusted; the other is of britannia metal or some similar alloy. One of the former may once have been brass-coated. Their diameters range from $\frac{1}{2}$ to $\frac{11}{16}$ of an inch. Like the above they may be buttons from work-clothes.
4. Unperforated (10). At present these metal buttons lack any means of fastening to a garment. Originally they were provided with cloth loops or shanks. At least four were once entirely cloth-covered. All are small, varying from $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter. One example has a hollow cross on its outer curved surface; another bears the inscription "Head Light," a brand name which still is used on men's work clothes. Some appear to have been sewn to overalls.

A miscellaneous lot of buttons includes the following:

1. Seven, four-holed bone buttons. Two are ornamented with an incised circle. They all fall in the same size group (small), with diameters of $\frac{1}{2}$ inch. Buttons of this sort were used on coats and trousers during the last 25 years of the 19th century. (Plate 3, third row).
2. Two pressed-paper buttons. The first and largest ($\frac{7}{8}$ of an inch in diameter) is broken. It has four perforations. The second specimen, $\frac{1}{2}$ inch in diameter, is unusual in having five holes. (Plate 3, third row, end).
3. A thick, hard-rubber button with two holes (Plate 3, bottom row). This black button bears the marking "Goodyear's Pat. 1851. R. Co." The specimen has a diameter of $\frac{7}{8}$ of an inch and is $\frac{3}{8}$ of an inch thick. It seems to be an overcoat button.
4. Three black ceramic buttons with bright surfaces. Each is provided with four holes for sewing to an article of clothing. Two are identical with $\frac{5}{8}$ inch diameters; the other is somewhat smaller, measuring only $\frac{1}{2}$ inch across. They are probably men's suit buttons. (Plate 3, bottom row).
5. A bluish-gray, two-holed ceramic button. It is decorated with an encircling groove near its border. The specimen is $\frac{7}{16}$ of an inch in diameter. (Plate 3, bottom row).
6. Two shank, glass buttons. The first is faceted and iridescent. It is of a variety that ornamented women's dresses in the 1880's. The other glass specimen is black and has a central groove. It could have been a shoe or fancy vest button. The faceted button is the largest with a $\frac{1}{2}$ inch diameter;



Plate 3: Miscellaneous buttons. Top row; mother-of-pearl. Second row; porcelain. Third row; bone and pressed paper. Fourth row; metal. Bottom row; rubber, ceramic and glass.

the other measures slightly less than $\frac{3}{8}$ of an inch across. (Plate 3, bottom row).

A brass hook, $\frac{1}{2}$ inch long, and an entire eyelet, $\frac{5}{8}$ inch long, were recovered. The metal clasp for an overall shoulder strap was also obtained. It measures $1\frac{1}{2}$ inches across.

Five whole and three fragmentary studs are in the collection. The largest, and oldest-appearing, is of bone and measures $\frac{1}{2}$ inch across. Its base is missing. Four, one with its head broken off, are made of opaque white glass. They are all of a size— $\frac{3}{8}$ of an inch or slightly less in diameter. Four concentric rings decorate the surfaces of two of these studs. Two plain specimens are of black-enameled metal. They have the same dimensions as the glass specimens. The facing of a mother-of-pearl example was also found. It also has a diameter of about $\frac{3}{8}$ of an inch.

Garment accessories include a rusted iron buckle from a man's narrow belt. It has a rounded end and dimensions of $1 \times 1\frac{1}{4}$ inches. The remains of another belt buckle were also retrieved but it is badly disintegrated.

Two unusual metal items are parts of military clasps of the Civil War period or possibly just before that time (Plate 1). The first, of brass, has an eagle design on a lined field of a type used between about 1850-1870. It appears likely that the object formed an accoutrement of one of the numerous California state militia groups. A manufacturer's mark about its border reads: "*Taussic. Pollack & Co. * San Francisco." A search of San Francisco city directories failed to turn up any reference to such a firm. Quite similar in form is the second article which is made of copper. Against a lined background is a five-pointed star design, the Texas state emblem, indicating that it may well be from the uniform of a Texas outfit, hence a Confederate clasp.

Articles used in mending clothes include two thimbles and a safety pin. The first

thimble, of brass, is complete though dented from use (Plate 1). It is nearly an inch long and has a basal diameter of $\frac{3}{4}$ of an inch—large enough for accommodating a thick finger. The second thimble, badly corroded and in pieces, was probably about the same size. The safety pin, of an old type, is $1\frac{1}{2}$ inches long.

The rusted upper plate of an old-fashioned sadiron was found (Plate 4). Irons of this sort normally came in sets of three—large, medium, and small. The recovered example is medium-sized, measuring $3\frac{1}{4} \times 6\frac{1}{4}$ inches. A nearly illegible manufacturer's mark seems to read, "Blesstorn & . . .". The iron was undoubtedly employed in pressing clothing as well as flat linens.

Footgear. Shoe and boot remains, all of leather, were fairly plentiful. All pieces unearthed had been well worn before being discarded. The majority appear to be from handmade boots, three of which are exceptionally narrow; others are parts of broad-toed workshoes. The thread with which they were sewn is still present on most specimens; a few bear nails or have nail holes.

1. Whole soles—1 complete and 4 fragments.
2. Half-soles—1 complete and 1 fragment
3. Sole fragments—8
4. Heels—5 almost complete, 3 fragments
5. Uppers (?)—2 fragments
6. A piece of leather from which a shoe sole had been cut.

A short ($1\frac{1}{4}$ inch) length of cotton shoe lace was found. It is so faded that its original color cannot be determined. A length of a thin leather thong may also be part of a lace.

Personal effects. Items under this heading are toilet articles, jewelry, writing equipment, coins and a pocket knife.

A few toilet articles were unearthed. These consisted of:

1. A bone toothbrush, lacking bristles.
2. A three-holed safety razor blade.
3. Four comb teeth, all black.
4. A black hairpin (? composition), $3\frac{1}{2}$ inches long
5. Two fragments from the lens of a pair of dark green sun glasses.
6. A metal stopper from a cologne or hair tonic bottle. The cap is decorated with a raised, leaf design and has a manufacturer's mark ("I M Mfg. Co. Pat. July 7 '14").
7. Two circular pieces of glass, probably from purse mirrors. The silvering has almost entirely disappeared. They are identical in size with a diameter of $2\frac{7}{16}$ inches, and are $\frac{1}{16}$ of an inch thick.

Objects used for personal adornment were rare with only one certain and two possible items.

1. A dark green, glass bead. The bead is globular and has a diameter of $\frac{5}{16}$ of an inch. One end is badly scarred.
2. A teardrop-shaped, mother-of-pearl object. This article could have formed part of a large, heavy earring. It might also have served as a chandelier pendant. The item is 1 inch long and $\frac{5}{16}$ inch thick.
3. A five-petalled ceramic rosette. This tiny object, only $\frac{5}{16}$ of an inch in diameter, could have been riveted to an ornamental comb or purse. In the center is a metal tube, or rivet.

Writing equipment was surprisingly well represented. Articles serving this function were:

1. A retractable metal pen (Plate 1). This article is nickel-plated and when extended has a length of four inches. Its corroded pen point is still inside. This is an example of a once-popular form of pocket pen with a reservoir of ink which automatically fed the nib while the instrument was in use. It dates back to the 1880's.
2. A metal pen point, $1\frac{1}{4}$ inches long.
3. Five pieces of angled, blue-green glass which appear to be parts of an ink-bottle.
4. Pencil fragments. These comprise: two upper ends of pencils, one yellow with eraser, one black; two pencil shavings (yellow); three pieces of black lead, two round and one flat.

Approximately one-half of a bone-handled, two-bladed pocket knife was unearthed.

Its original length was about three inches. The remaining pieces is $\frac{3}{8}$ of an inch wide. The faint outline of a shield design is visible on one side.

Only three coins were recovered. All were United States Lincoln-head pennies. Their dates are: 1919, 1919, and 1940.

Tools. Daily work activities were not well illustrated by archaeological finds, as relatively few hand tools and pieces of farm equipment were unearthed. Actually, recovery of articles of this sort in or around a ranch house is not anticipated as they are ordinarily kept and utilized elsewhere. When no longer usable, such items were probably thrown away in the vicinity of the outbuildings in which they were regularly stored, or disposed of in trash pits.

A broad-bladed hatchet, six inches long and five and a half inches wide, was found (Plate 4). This is a general utility tool of a type regularly used in the past by carpenters for dressing timbers. It is square-ended and suitable for driving nails as well as for chopping and trimming wood. The hatchet has a wider aperture for the insertion of a handle than its modern counterparts. Aside from being rust-encrusted, it is in good condition.

The only other hand tool recovered was a heavy (8 lb.), double-faced spalling hammer of forged steel (Plate 4). This tool, provided with a 36-inch handle of straight-grained, second-growth hickory, is employed in splitting rock. The round hole for insertion of a handle is surprisingly small, having a diameter of only $1\frac{1}{4}$ inches. Present-day spallings have thicker edges than the one unearthed.

Although the principal economic pursuits at Santa Anita were always farming and stock-raising, only a few scattered finds reflect these activities. A single cultivating tool was turned up. It is a broad, iron hoe blade (Plate 4). This is a "plantation" hoe. Equipped with a long wooden handle it was suitable for heavy hoeing and chopping weeds. The blade, $6\frac{3}{4}$ inches wide and $5\frac{1}{2}$ inches high, was forged and drawn from one solid piece of metal. The handle hole has a diameter of one inch.

Some objects of horse equipment were found. There are two horseshoes. One is little-used and still has both toe and heel calks; the other is considerably worn. Their dimensions are $4 \times 5\frac{1}{2}$ inches and $4\frac{3}{8} \times 6$ inches respectively. Several pieces of leather appear to be parts of harness. The largest fragment has slits in its surface and two layers of leather are riveted together. There are also four short lengths of strap and 12 nondescript leather scraps.

A twenty-inch section of straight-link iron chain was retrieved. The length is made up of eleven two-inch links. Its former use is unknown but it could have been placed about a cow's neck. The chain is not strong enough to have served as part of a piece of farm equipment.

A whole game trap was found (Plate 4). It is a Number 1 "single spring" type, with a four-inch jaw spread and adapted for trapping skunks and other small mammals. It is provided with a short length of chain and a pin for attachment to a log or floor beam. Identical traps manufactured by the Victor Company can be purchased today.

Weapons. Considerable evidence was obtained for the use of firearms. During earlier years of the adobe house's occupancy, firearms were essential for protection against marauding bands of Indians, whose habit it was to raid outlying ranchos, (Caughey 1952, XX). In later years firearms were employed presumably in shooting game and wildfowl and for driving off predatory animals and birds. It seems likely they were also used for target-shooting, a favored pastime of many ranch hands.

Especial interest attaches to the finding of a brass trigger-guard from an old-style rifle (Plate 1). It is of a class made by hand during the period between 1800 and 1850 for attachment to a long-barreled, powerful Kentucky rifle. The trigger guard is large,



Plate 4: Tools and other objects of iron. Top row (left to right) spalling hammer, hatched blade and hoe blade. Bottom row; sadiron plate, pulley, animal trap and ladle.

having a length of $7\frac{3}{4}$ inches and a maximum width of $\frac{7}{8}$ of an inch. It is in excellent condition.

All photographs, including the cover, were taken by the authors.

To be continued

COVER, PLATE 1

An assortment of metal objects found in and around the Hugo Reid Adobe by the archaeologists of the University of Southern California and the Archaeological Research Associates during their excavation project in 1956. An article by their leader, Dr. William J. Wallace, will be found in this issue of *Lasca Leaves*. The objects in the picture are identified as: Top row (left to right) key and retractable pen; Middle row: clasps, drawer handle and thimble; Bottom row: trigger guard from Kentucky rifle.

SORRY

Correction in Footnote, pg. 17 in *Lasca Leaves*, Winter 1961, Vol. XI, No. 1 for article by Susanna Bryant Dakin, "*The Restoration at Rancho Santa Anita*."

"Line 1: should read: 'Los Angeles-Pasadena Committee of the National Society of Colonial Dames in California'".

"Line 2: should read: 'their first restoration in Southern California'".

"Line 3: should read: 'Norman-Wilcox is Curator of Applied Arts at the Los Angeles County Museum'".



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HORTICULTURE

Roses in Descanso Gardens

Conclusion

JOHN L. THRELKELD

This article began in *Lasca Leaves*, Vol. XI, No. 2, 1961*Ten Best Roses from 1900-1940 Eras in Descanso Gardens*

Belinda (Hybrid Musk). The flower heads of this variety are the largest in its class. It is not unusual on a mature plant to find an individual cluster of flowers 12 inches in diameter and 18 inches deep. It is possible to cut a complete bouquet on one stem. Individual flowers are about 1¼ inch in diameter, rose-colored, showing white centers. As a shrub rose, it compares favorably with the Gartendirektor O. Linne rose and any other sun-loving garden plant.

Cascadia (Shrub Rose). This plant is a vigorous grower and a profuse bloomer. The individual white flowers are about 1 inch in diameter and are borne in clusters of up to 25 or more flowers, the full length of the arching cane.

Dainty Bess (Hybrid Tea). The Hybrid Tea, introduced in 1925, has never been replaced by any more modern introduction. When cut in the tight bud stage, this rose lasts several days as a cut flower, even though it is a single, five-petaled rose. The bush is vigorous and hardy. The flowers are produced in clusters of from 3 or 4 to as many as 10 or 12. The flower size is about 3 inches. The surface of the petals upon opening is a creamy-pink. The reverse of the petals is a darker pink. Vermilion stamens and golden pollen complete the picture.

F. J. Grootendorst (Shrub Rose: *R. rugosa rubra* X unknown Polyantha). The unusual flower of this rose makes it a valuable addition to any collection. To the casual observer the individual flower could very well be mistaken for a small carnation. The outer edge of the petal is deeply and evenly serrated. It is fully double, about 1¼ inch in diameter, and is borne in few-flowered corymbs.

Frau Karl Druschki (Hybrid Tea). Introduced in 1900, this rose has maintained a popular role ever since it first became known. It is a Hybrid Tea, bearing enormous white flowers. The outer petals in the bud stage show crimson. No one who knows and enjoys roses will need to be introduced to this variety.

Gartendirektor O. Linne (Hybrid Musk X Polyanthus). For garden color and profusion of bloom combined with good growth characteristics, beautiful foliage and insect and disease resistance, there are few garden plants of any genus which can excel this plant. The flowers are borne in huge clusters measuring 8 to 10 inches in diameter. The individual flowers are semi-double, clear bright pink with a white center, about 1½ inches in diameter.

Grootendorst Supreme (Hybrid Rugosa). This Hybrid rugosa is a vigorous rose which will adapt itself to nearly any garden condition. The foliage is of the typical rugosa nature. It is extremely thorny and can be used as an effective screen plant or bank cover. The flowers are brilliant maroon-red, about 1½ inches in diameter, semi-double and borne in corymbs of up to 12 flowers.



The *Rosa moschata* is an important species rose having given rise to a group known as hybrid musk roses. This type of rose is noted for its rich, spicy, fragrance and great vigor.

Mermaid (Hybrid bracteata). The brilliant yellow single flowers of this variety often measure to 4 or 5 inches in diameter. The thorns remind one of rattlesnake fangs, and indeed, are almost as vicious. When used as a shield planting, it is completely effective.

Schneezwerg (R. Rugosa X Polyantha hybrid). This variety has white color characteristics which have been constantly sought-after by rose breeders since the art of hybridizing has been known. The flowers are semi-double, 2 inches in diameter, showing yellow stamens, and are a pure white. It is a prolific bloomer, having shiny hard, disease-resistant foliage. The fragrance is slight but pleasant.

Sheelagh Baird (Polyanthus). This is an exception to the rule that the polyanthus class is out-of-date. This rose blooms in great clusters sometimes measuring 8 to 10 inches across. The individual flower is many-petaled, semi-double, about 2 inches in diameter. The color is light pink, fading to nearly white. The foliage is waxy and is almost completely free of insect and disease pests. Its vigor and hardiness cannot be excelled in the small-growing class of rose. Its ever-blooming characteristic is not excelled by even the most modern introductions. By conscientious removal of the faded flower heads, continuous bloom can be obtained from early May until frost. In mild climates it is nearly evergreen.

Rose Development—1940 to Present

In 1940 a nation-wide organization known as All America Rose Selections, Inc. was established. It was the purpose of this organization to test in all climatic conditions of America, new rose varieties which were felt to have merit.

Hundreds of new varieties were being introduced each year, many of which were very definitely inferior stock. The frantic trend toward hybridizing to take advantage of the Plant Patent Law and other economic situations could very well have led to the complete breakdown of commercial rose growing in the United States.

The establishment of the AARS test gardens brought about a unified effort toward increasing quality across the nation. These test gardens are maintained under the expert and watchful eye of rosarians under a wide variety of climatic and growing conditions. In different parts of the country throughout the growing season, accredited judges inspect the roses undergoing test. A point system of grading is used for comparison. At the conclusion of the growing season the scores from across the nation are tallied and the rose or roses having the most outstanding qualifications and highest scores are given the award for that particular year. They are then propagated and distributed by the millions for introduction to the American and world garden trade. The Descanso rose collection includes the complete list of AARS winners.

Ten Best AARS Winners Grown in Descanso Gardens

California. 1941. Hybrid Tea. Two characteristics of the California make it outstanding: the burnt-apricot color, and the plant seems to improve with age, blooming its best after many roses have passed their peak production period.

Capistrano. 1950. Hybrid Tea. The immense, brilliant pink flowers on long stems make this variety especially valuable as a cut flower. The fragrance of a small arrangement will permeate the air of a large room.

Charlotte Armstrong. 1941. Hybrid Tea. This lovely cerise colored rose is the most valuable plant on the American garden scene. It is a parent to more AARS winners and other classic roses than any other plant. In fact, it is a rose which will undoubtedly be esteemed by rosarians as long as roses grow.

Chrysler Imperial. 1953. Hybrid Tea. This plant originated in Descanso Gardens under the hand of Dr. Walter E. Lammerts. No garden should be without this spectacular, dark red flower, which typifies perfection during all stages of development, from the immense bud to the gigantic full-petaled open flower.

Fred Edmunds. 1944. Hybrid Tea. The choice apricot-orange color of this variety is its greatest asset. When planted among other roses, it adds the necessary degree of unusual color to highlight the planting. Not only does it stand out itself, it also seems to brighten the surroundings and other varieties.

Helen Traubel. 1952. Hybrid Tea. This variety mellows with age and with the extension of the growing season. The most notable thing about this plant is the immense, pointed, pink to apricot colored bud late in the growing season. Although the buds are nice in the spring, they don't rate the adjective sensational until later in the season.

Queen Elizabeth. 1955. Grandiflora. The original seedling of this choice variety was grown in Descanso Gardens by Dr. W. E. Lammerts. The performance of this plant is exceptional in every way, from the first vigorous canes which appear in early spring to the full-blown, clear pink flower which fades in autumn.

Sutter's Gold. 1950. Hybrid Tea. The markings of burnt-orange and pink shadings in the predominantly yellow flower of good size makes this variety outstanding. Its vigorous growth and good shape makes it a good landscape plant.

White Bouquet. 1957. Floribunda. The performance of this plant is exceptional in every way. The plant is vigorous and responds well to ordinary garden care. Of course, the most valuable thing about this plant is the truly beautiful white flower, which is particularly good in either bud or the open flower stage.

Sarabande. 1960. Floribunda. This variety may be destined to the field of the classics. It is one of the outstanding landscape roses to be introduced. It is single, light orange-red blooming in large trusses. It has received more international awards than any other floribunda. Its performance in Descanso Garden is outstanding.

Ten Best Modern Rose Varieties Grown in Descanso Gardens

Capistrano. AARS 1957.

Carrousel. This Grandiflora class rose is one of the finest ever introduced into Southern California horticulture. Its performance is nearly perfect. The beautiful dark red, velvety-textured bud and open flowers vary only slightly in quantity or quality from one season to another. It is one of the first Modern Roses to bloom in the spring and among the last to stop in the fall. Its growth requirements are not at all exacting; however it will respond well to good care.

Charlotte Armstrong. AARS 1941.

Chrysler Imperial. AARS 1953.

Descanso Pillar. For mild climate growing, there is no plant which will give more color or adapt itself to a wider variety of uses than this spectacular pillar rose. It will grow upright to a height of 8 feet without support. If supported in the center by a pillar (from which this type derives its classification), post, or other support, it will reach a height of 12 to 15 feet. Under the conditions in the Descanso Rose Garden, it is not grown with support, but is pruned each year to allow a maximum height of 7 to 8 feet to be reached. Its use as a background plant or as a specimen plant cannot be equalled. The length of the stems for each cluster of roses will usually attain a length of three feet or more. The individual flowers will reach 4 inches in diameter and is borne in clusters of from 15 to 25 roses. This rose is the arranger's ideal for use in large arrangements. The flower is colored a bright cerise-pink. The edges of the petals are sometimes irregularly serrated.

Little Darling. This Floribunda is unusual because of the size of the plant and the magnificence of the individual flower. The plant is about twice as large as the normal Floribunda both in height and width. The leaves are small and so are the flowers, each one being about 2 inches in diameter, fully double and richly multicolored, but predominantly yellow. The plant blooms in medium-sized clusters. The individual plant will produce almost twice the quantity of flowers as the average Floribunda.

Mark Sullivan. The brilliant, deep burnt-orange color of this Hybrid Tea makes this rose a lively garden addition. It blooms in great profusion, nearly obscuring the leaves and shape of the plant from view.

Queen Elizabeth. AARS 1955.

White Bouquet. AARS 1957.

Sarabande. AARS 1960.

BASIC FACTORS IN ROSE GROWING

The individual rose differs as much in its growth requirements as does one child from another. Perhaps the most basic of all requirements for growing beautiful roses is for the grower to have a deep-seated desire to grow beautiful plants. This being the case, he will familiarize himself with the available writings in books on rose culture, in rose catalogues, and by conversation with persons who are obviously successful in their endeavored rose growing.

During the course of his investigation he will find that growth requirements are not essentially different from growth requirements of any other living thing, whether it be plant or animal, but there will always be individual adaptations of basic requirements. The factors must be at hand to produce growth which will make the plant reach maturity, reproduce its own kind, which will in turn condition itself to the surroundings.

Natural Requirements

In growing roses, the closer the conditions provided come to being ideal, the better will be the results. The ideal rose soil is deep, rich and full of humus. It is well drained yet has good moisture holding qualities. It is free from competing roots of other plants. It is in an open situation with unrestricted light. There should be a minimum reflection of light from a building, fence or other structure.

Planting Methods

Planting methods vary according to climatic conditions and local practices. In Descanso Gardens, the general policy of planting all plants high in relation to root and ground level is practiced. This requirement is especially valid when a thick mulch is to be used. Indeed, it could be recommended that it is better to have a root or two exposed than to have them covered too deeply.

In all cases, care must be taken not to have air pockets around the roots or particularly under the root crown of the plant. Soil should be compacted firmly around the roots by normal hand pressure rather than by tamping with an instrument. The correct degree of solidity will be achieved when the plant is watered.

Irrigation

In an arid climate, sufficient equipment for irrigation should be easily available. Irrigation may be done by flooding or by overhead sprinkling. Should the latter be the chosen method, it is best done in the early morning with a fine spray which will not damage open flowers and at a frequency of at least two to three times weekly to wash off mildew spores. If roses are sprinkled when the sun is high, considerable burn to foliage and flowers may result.

Fertilizing

The nutrients in the soil should be replaced consistently in order that growth factors may be always in balance. Roses are heavy users of nearly all soil nutrients, therefore, a fertilizer formula containing all of the basic nutrients, as well as all of the minor elements known to be needed, should be used. The soil acid-to-alkaline reaction, or pH, should be about neutral or slightly acid.

Mulch for Weed Control

Wherever lovely plants are grown there is the eternal problem of weeds. A weed is defined as any plant growing in a situation where it is not wanted. A thick mulch is one of the best weed controls known. It has been determined in Descanso Gardens that sawdust from nearly any type of wood, placed evenly over the rose bed three to four inches thick is an excellent mulch. Care must be taken to provide ample nitrogen to compensate for the loss of available nitrogen in the decomposition of the sawdust. The regular feeding program must not be neglected when using mulch. In fact, a little extra feeding for the mulch would be beneficial.

A mulch is essential for reasons other than weed control, such as; conservation of moisture, encouragement of soil microorganisms beneficial to plant life, maintenance of more even temperatures at root level, to name but a few. A wide range of much materials from shavings, undecayed leaves to beanstraw may be used. Which material to use is not as important as the fact that something is used.

Overhead watering is essential when using a mulch. Care must be taken however, not to overwater. Periodic checks should be made to determine that water is getting through the mulch to the plants and penetrating the soil into the root area.

The least satisfactory method of weed control is backbreaking hoeing or intense cultivation. Not only is the hard work method damaging to shallow feeder roots, it is also quite expensive, considering labor costs today.

Pruning

Pruning should be performed more or less constantly, removing dead wood whenever it is noticed, and removing faded flower heads before seeds can be produced, unless, of course, one is desirous of harvesting the seeds or hips. Reduction in size of the plant or any extensive thinning of green wood should be performed during the most dormant season. In California this season is generally late January and early February.

It has been found that individual varieties and species of roses react differently to pruning. Some will take severe pruning and spring back with vigor each year, while others seem to resent severe pruning, preferring only a thinning. In fact, it would appear that some roses are tolerant of heavy pruning and others are intolerant. None prefer it.

It is difficult to give a rule of thumb to tell the kind of pruning the varieties will tolerate, but generally it could be said that those varieties which grow strong basal canes can take heavier pruning than those which grow smaller twig-like branches.

All Floribundas resent heavy pruning. Grandiflora and Pillar roses prefer to be pruned high with occasional complete removal of aged canes. Most species and old-fashioned types of roses can take very severe pruning even to the extent of complete removal of all of the previous year's wood. They will thrive, however, with no pruning, the difference being in space required for growth.

Climbing roses, and most old-fashioned types, prefer pruning immediately after blooming, when canes which have just flowered should be removed. Where unlimited space is available to the climbing roses, they will thrive year after year without any pruning.

Pests and Diseases

It seems that roses are the favorite diet of practically every insect and leaf-eating animal that comes along. For instance, deer in Southern California will pass up ceanothus which is their basic food, for roses. They seem to approve of modern hybridizing methods, because they prefer the modern roses over the old-fashioned or shrub roses. The multiflora species which is commonly used for understock in the midwest and eastern states provides a forage, choice above all others, for cattle and horses. Gophers, of course, are especially fond of rose roots.

This information is not being pointed out in order to discourage rose growing, but rather to point out the fact that the odds are against growing good roses if one does not follow a good pest control program. A good pest control program does not necessarily mean sousing the plant with a poisonous material every Monday morning. In fact, a practice such as this would do much more harm than good. The best program to follow to have a pest-free garden is to practice clean gardening along with spraying with the appropriate material only when the need arises.

Rose gardens equipped for overhead sprinkling have fewer pest control problems than gardens where flooding or basin filling is practiced. The fine droplets of water falling as rain have a definite cleansing action on the roses, discouraging both insect and fungus disease. Overhead sprinklers should be selected for their evenness of application and fineness of water droplets. A coarse, forceful sprinkler will damage open flowers.

Cutting Roses

Providing the aforementioned principles of culture have worked to produce beautiful flowers, there remains even a right way and a wrong way to cut them. One should never fear to cut a rose with a long stem. In fact, in cases where the stem is growing inward instead of outward or is causing a crisscross pattern among the branches, it can be removed in its entirety. It should be remembered, however, that each leaf of the plant is a complete food manufacturing unit. The more leaves the plant has, the more food manufactured.

Where the stem is growing to an advantage for the bush it should be cut down as far as the first strong bud from the main stem. That bud will then grow on to produce another fine flower. In gardens where flowers are not grown for cutting they should be removed before they can set seed. In this case the flower should be cut to the first bud from the flower end of the stem.

Landscape Uses of Roses

Most rose gardeners plant only Hybrid Teas, Grandifloras and Floribundas and occasionally Climbers. Their use is almost entirely in a formal garden setting or in small groupings used primarily to fill space. This is because the commercial growers have limited their production to these types. Consequently, most of the buying public does not know that other interesting forms of roses grow. In discussing the landscape use of roses, it is hoped that a few points of interest can be given to encourage gardeners to put the magnificent rose family to greater and more varied use.

Hybrid Teas

There is enough varietal differences among the Hybrid Teas to cause the use of this class in many more different circumstances than they are currently used.

Many very pleasing garden effects can be achieved by using certain Hybrid Teas as shrubs planted either in groups or individually among evergreen plants. The informal use of such roses is certain to create interest far beyond that of the normal concept of rose growing. Under such conditions, regular garden care should be afforded these plants; however, roses bloom more than most other shrubs so more frequent attention will be necessary. Continuous removal of faded flowers throughout the season should be done to prevent seeds from setting which would reduce the plants' flower production. Dead or diseased wood should be removed at any time during the season when it is noticed. Occasionally, complete canes will lose their vigor and should be entirely removed, making way for new vigorous growth to replace it. This should be the extent of pruning for growing in this manner.

Sufficient space should be allowed for these plants to reach maturity. In the cases of some varieties, the size is astounding. Charlotte Armstrong, for example, will reach a height of 8 feet or more and a width of approximately 5 feet. Other varieties such as California, Chrysler Imperial and Capistrano are almost equal to the Charlotte Armstrong in size. No plant will give more color or greater garden satisfaction than a rose grown as described here if sufficient space is available.

For public garden use or for large home grounds interesting effects can be produced by growing Hybrid Teas in mass informal plantings with beds varying from the width of three plants up to as many as fifteen or twenty. Very pleasing color combinations and patterns can be created by careful selection of varieties.

Of course, the gardener who grows Hybrid Teas as described here must become acquainted with the growth characteristics and requirements of the individual varieties. Being hybrid in origin, much diversity of form and habit is to be encountered. Certain varieties will perform much better than others in certain localities.

Floribunda Roses

This class of rose is of modern introduction and is certainly a wonderful addition to the garden scene. Its use is ideally suited to either formal or informal plantings. Even under the most formal conditions, very little shaping and pruning is required for the control of growth habits.

A sunny hillside or slope can be completely covered with a blanket of color for at least eight months out of the year in mild climates by the use of Floribundas.

For container growing or for use in planter boxes in sunny locations, the Floribunda cannot be equalled. In all cases, Floribundas should be planted closely, even to the point

of some overlapping of branches. In this manner the effect of the individual is lost, and the planting as a whole assumes individuality.

The necessity of deep mulch, from 3 to 4 inches in depth, cannot be over-stressed when mass plantings are used.

Grandiflora Roses

The Grandiflora is a new class of rose, being a cross between the Hybrid Tea and the Floribunda. Its natural tendency is to have increased vigor of the Hybrid Tea with the clustered flowers and profusion of bloom of the Floribunda. The Grandiflora is so new that it is difficult to actually know or predict its ultimate usability in the garden.

As it is currently used, it is outstanding in a formal or informal garden setting. It makes an ideal midground to background plant when used with other roses, or it is ideal for mass bed planting where a height greater than Floribunda is desired.

Some of the most choice modern flowers are in the Grandiflora class. Leading varieties are Carrousel, Queen Elizabeth, Montezume and Buccaneer.

Climbing Roses

The best effects when using climbing roses can be achieved when they are trained properly from the beginning. Too often a climber is left to its own for too long a time, creating a dense thicket which is next to impossible to bring under control.

For covering an arbor, a trellis, a wall or fence, the best procedure in training is to judiciously care for each cane individually, placing it in the desired position and tying it to make sure that it stays there. Climbers produce flowers on wood that is one year old. Wood that is older than that tends to pile up and cause confusion and great distress when time for removal comes along. It should be remembered that many more roses will be produced on canes growing horizontally than on those which are upright.

The climbing rose, for use in the situations as described here, is limited to those gardeners who have the time and the enthusiasm necessary for the continued attention required. Where such enthusiasm is lacking, much better results could be obtained by the use of other vines which do not present as rampant and entangling growth.

Other uses of climbing roses in the natural landscape are extremely rewarding. Climbers, of course, require much more space for development as natural plants than do other types of roses. As bank covers or as living fences, climbers are extremely efficient. Under these conditions little or no pruning should be performed except as necessary to keep the plant within its proper bounds. Of course, removal of faded flowers is impossible under such conditions. Therefore, it is not likely that a prolonged succession of bloom will be enjoyed. Certain varieties excel for growing under natural conditions. Certainly the Mermaid is one of the best.

Where space is no problem, a climbing rose may be used as a specimen plant in a lawn or other expansive area. The plant may be allowed to grow up until the canes become top-heavy and arch to the ground themselves. During bloom periods great mounds of flowers are to be appreciated.

Other uses of climbing or rambling roses are to let them naturalize at the edge of a wooded area or to actually train them when young to grow into the sunny side of trees. Many very pleasing effects have been achieved, either purposely or accidentally, in many sections of the Southern United States, by the use of the Cherokee rose in this manner.

Climbing roses, when used properly, can be a great garden asset, but when improperly planted and cared for, there is perhaps nothing in the garden which can be so perplexing or so difficult to handle.

Pillar Rose

The Pillar Rose with annual pruning will grow to 8 feet or slightly more without

support. When allowed to grow naturally, without support or pruning it becomes an awkward, gangly plant which will actually break itself to pieces within two to three years. By tying it to a pillar or post (this is where it gets its name) it will grow to 12 or 15 feet.

The Pillar Rose is not to be found in nature. It is a creation of man, having been hybridized between bush roses and climbing roses. It is entirely possible to use a Pillar type rose in an informal landscape by placing it in the background of lower-growing *Grandiflora* or bush varieties.

The most outstanding modern examples of Pillar Roses include the *Descanso Pillar*; the *Sunny June*, a very delightful, single, yellow variety; the *Golden Showers*, an AARS introduction for 1957; and *High Noon*, an AARS introduction for 1948.

Tree Roses

Like the pillar rose, there is no such thing as a Tree Rose in nature. It is strictly the handiwork of man by grafting methods. Therefore, it is impossible to grow a Tree Rose informally. Its best use is along a driveway or walk or as a specimen plant in a lawn or patio.

Tree Roses have ebbed and flowed in popularity for many years. At the present time they are in the ebb stage. However, it appears that certain architects are leaning heavily toward formalization, so perhaps in the not too distant future their popularity will begin to grow again.

Species and Old-Fashioned Roses

The tendency of modern gardeners to always purchase the newest available plants has caused an overlooking of many of the most interesting and useful of all roses. There are classics among the species and old-fashioned roses no different from classics in music,



Descanso Gardens is surrounded by the beautiful background of the San Rafael Hills. This picture shows the northern-most rise of the hills in the background. The San Rafael Hills are named for the Rancho San Rafael, a 64,000 acre land grant from the King of Spain to Jose Marie Verdugo in 1784. Descanso Gardens is the last remaining acreage of this famous rancho.

art, literature and drama. It is not expected that these classics will become universally popular. In fact, much of their appeal would be lost in such an event, but much wider use of them would add a great deal more garden interest.

Listed at the beginning of this article are selections from the Descanso collection which are thought by the writer to be classic in their fields.

The landscape use of these species and old-fashioned varieties is especially adapted to special effects use and to specimen use where their unusual characteristics can be best presented. Many of these classic roses can be used in a garden much the same as an artist would use outdoor sculpture, placed to show off the article to best advantage and to harmonize with the surroundings.

No greater thrill could come to a garden-lover than to watch the seasonal changes which are so spectacular in many of these classic roses. A typical example would be the *Rosa macrophylla doncasterii*, which goes through a complete transformation from the production of delicate pink, single flowers and lacy foliage in the spring to the bright orange-red seed hips and glaring red canes which present an exciting autumn and winter display.

Summary

To summarize the landscape use of roses, much is to be gained by both the rosarian and the designer in becoming more fully acquainted with the great diversity of forms and characteristics possible to achieve with roses. Indeed, it could be said that the limitations on the use of roses in the landscape would be applied only by the limits of the imagination of the designer and the gardener.

The Future of Roses

It is difficult to imagine the changes of characteristics and the improvements which the future holds for roses. Upon appreciative observation of many of the new varieties, in which the individual flower has achieved such perfection, it is hard to see how a great deal of improvement can be made. But certainly no one is completely satisfied with the growth characteristics and the disease and insect resistance of the modern plants. Many of the old-fashioned species and varieties have characteristics in this regard which would certainly improve the lot of modern roses.

Some breeders are turning toward improving the quality of foliage and resistance to disease, while others are working toward creation of new and exciting color breaks. One prominent California breeder is working toward the development of a blue rose, and reports that progress is very encouraging. Should this field in color be opened, many other color combinations and interesting characteristics can be expected in the future.

The popularity of the rose family in general has never waned except for short periods in history. This is because the rewards are so great and because the requirements of achieving these rewards demand considerable effort on the part of the gardener. Things which become too easy are often discarded for something that presents more of a challenge. Roses continually offer challenge, therefore interest continues at a high level.

Beauty and the enjoyment of beautiful things are as essential to humanity as are food, air and water. No efforts of man can more adequately fulfill this human need than the growing of beautiful flowers, and certainly the rose is uppermost in this regard.

The Descanso rose gardens afford the opportunity for anyone interested in broadening the horizons of his understanding of this choice plant to observe side by side nearly every known type and classification of the Genus *Rosa*.

COVER

The history of the rose garden pictured, contains what is probably the world's most complete collection of rose species and ancient rose varieties. The garden is designed to display the roses in their proper order of introduction beginning with those known to be growing before 1500 A.D.



California Arboretum Foundation, Inc.

California Arboretum Foundation, Inc. is making available to the public the design reproduced above, as a french fold card with envelope suitable for use as informal stationery, Christmas card or invitation. Cards and envelopes are of fine quality stock, and will be suitable for imprinting or for written messages. Minimum orders for ten cards and envelopes will be accepted and orders will be filled beginning August 15. The following price schedule has been established for these boxed cards and envelopes:

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Historic Objects from the Hugo Reid Adobe

Conclusion

WILLIAM J. WALLACE AND E. S. TAYLOR

This article began in *Lasca Leaves*, Vol. XI, No. 2, 1961

Several forms of ammunition were turned up. Included are 17 lead balls, of three sizes.

1. 0.318 inches in diameter. There are four of these small balls. They are probably buckshot. If fired from shotguns they were utilized against larger animals or humans. This caliber of lead ball was also fired in 31-caliber pistols.

2. 0.375 inches in diameter. There are seven examples of this caliber. They are pistol balls and could have been discharged from a Colt .36 or by a pistol of another make, the Manhattan, which fired the same sized ball.

3. 0.4-0.5 inches in diameter. These six larger, heavier balls could have been fired from a rifle or from a pistol.

Undoubtedly used with the lead balls were seven brass percussion caps, all fired. The lead stopper of a container for percussion caps was also unearthed. It bears the label: "Du Pont & Co." and is decorated with a flower outline in the center.

Although no bullet mold was found, there is good evidence that at least some lead balls were made in the house. Several specimens have waste pieces attached to them as if they had just been taken from the mold. An iron ladle perhaps served for pouring the molten lead, (Plate 4). The bowl measures 2½ inches across; its handle, welded to the bowl, is about 5½ inches long. The ladle is unusual in lacking a pouring lip.

Twenty-two brass cartridge cases, mostly of the old rim-fire variety, were retrieved. With one exception they are from pistol cartridges. The following identifications were made:

1. 22-caliber, long, rim fire (1). Union Metallic Cartridge Co., Bridgeport, Conn.
2. 22-caliber, extra long or long rifle (1). Henry (now Winchester) Rifle Co.
3. 32-caliber (approx.), rim fire (3). These are unusual because of their short length and deeply creased bases. No manufacturer's mark is visible on any of the cases.
4. 38-caliber, rim fire (4). Henry Rifle Company.
5. 41-caliber, rim fire (12). Henry Rifle Company.
6. 41-caliber, center fire (2).
7. 52-caliber, rim fire (1). Sharps and Henry (?). This is an unfired rifle bullet.

A distorted lead slug, probably fired from a .38 caliber pistol, was also recovered.

Three brass cap ends of shotgun shells were found. They are of 12-gauge size and the large buckshot described above could have been fired in them. All are of the center fire type. The first, of British manufacture, bear the mark "Eley Bros, London, No. 12." The second is inscribed "Winchester, New Rival, No. 12"; the third shell is a "Winchester, No. 12."

The only other indication of use of weapons is the brass end of an unornamented knife or dagger sheath. One side of this object is straight, the opposite is curved. Its dimensions are 1 x 1½ inches.

Playthings. Excavated were some articles which demonstrate that the house's tenants had time to enjoy at least a few pastimes. That they found amusement and relaxation in an occasional card game is attested to by the finding of five playing cards and one poker chip. Four cards, apparently hidden, were recovered from behind a baseboard in one of the rooms. They were all from the same deck, which had red printed backs. Their manufacturer was the "Consolidated Card Company, New York" and they are of the "Hustler 94" variety. Included are the ace and six (?) of spades, seven of clubs, and joker. Price lists dated July 1, 1900 show that "Hustler 94" playing cards were one of the regular brands sold by the New York Consolidated Card Company. It is reasonably safe to assume that the loose cards found are not less than fifty years old and possibly quite a good

many more. Another card, with a blue-figured back, had been folded and cut to form a gasket with three holes punched through it.

The poker chip is made of a red ceramic material. On both surfaces, enclosed in a circle, are the initials "MN" in faded white. The chip has a $1\frac{1}{2}$ inch diameter.

The playing of a musical instrument is shown by the finding of parts of a small ($1\frac{1}{8}$ x $4\frac{5}{8}$ inch) harmonica. Recovered were the brass reeds and wooden center piece. When some of the thick, green corrosion was removed from the brass, a manufacturer's trademark became partially visible but was not legible.

Smoking tobacco was probably a common relaxation. Tangible evidence for this custom was found in the form of pieces of inexpensive clay pipes. Unearthed were:

1. Three bowl fragments of white clay pipes. One piece is decorated; another bears a raised "D" on its outer surface; a third has a similar "I". All are smoke- and tobacco-stained.
2. Two stem pieces of white clay pipes. Neither is marked in any way. Their external diameter is $\frac{1}{4}$ inch.
3. A mouthpiece of a ceramic pipe with a yellowish-brown glaze. It has a maximum diameter of $\frac{1}{4}$ inch.

What may be a homemade pipestem was uncovered. It is a crudely whittled hollow wooden tube, burned at both ends. This tube could have been inserted in a corncob pipe. It is $2\frac{5}{8}$ inches long and has a diameter slightly exceeding $\frac{1}{4}$ inch. A much-rusted tobacco can was also found. Perhaps used by smokers were five burned matches. They are of a size favored by pipe smokers. A wooden matchbox cover, with its cardboard sliding tray, is labeled "Diamond Match Co. No After Glow" on one surface; on the reverse side is "Safety Mo . . . Impregna . . . Red T . . .". The box is small, with dimensions of $1\frac{1}{2}$ x $2\frac{1}{4}$ x $\frac{3}{4}$ inches. It is the "Red Top" brand's strike-on-box or safety match, first referred to as the "Swedish Style" when introduced by the Diamond Match Company about 1891. The box found was probably made at a much later date, around 1920 or 1921. The torn upper corner of the bottom of the box wrapper originally read "Strike on box." On the front cover, the second word should read "Impregnated."

Newspaper reading was also indulged in. Bits of dirt-stained and fragile newspaper, some wadded as if stuffed into knot- or rat-holes, and others rodent-chewed, were found. Two lots are from Chinese-character newspapers; the others are in English. Recognizable are the "Pasadena Star" and the "San Francisco Call." The only decipherable date was "June 17, 1915" for the Pasadena Star, and January for the San Francisco Call; all news items pertained to World War I.

Representative of children's games are ten marbles, a tiddly winks, a die, two pieces from dolls, and a broken and rusted wheel. The marbles occurred in several materials and sizes (Plate 5).

1. Porcelain, plain, dull white surface (2). Diameters of $\frac{5}{8}$ and $\frac{7}{8}$ of an inch (Plate 5, first row, first specimen).
2. Porcelain, decorated, shiny white surface (6). Four marbles have encompassing rows of blue, green, and orange lines forming a tartan design (Plate 5, first and second rows). One has three encircling orange bands and two opposing green flower designs (Plate 5, middle row, last specimen). An unusual specimen has five circle-and-dot designs, two green, two orange and one blue (Plate 5, bottom row).

Diameters range from $\frac{5}{8}$ to $\frac{3}{4}$ of an inch.

3. Porcelain, shiny, brown mottled surface (Plate 5, bottom row). (1) Diameter $\frac{3}{4}$ of an inch.
 4. Glass, with interior design (1). This, the only glass marble, has an interior red, white and blue spiral and concentric yellow lines. Its diameter is $\frac{7}{8}$ of an inch. (Plate 5, bottom row, largest).
- Assigning specific names to the various forms of marbles is difficult as the vocabulary of marble-playing is large and there are regional, generation, and other differences in terminology (Harder 1955). Accurately dating them is also hard to do as some types have been on the market for many years. As a group, the specimens appear to be fairly old, probably dating back to the latter decades of the 19th century. The large glass marble is, for example, a variety imported from Germany prior to World War I.

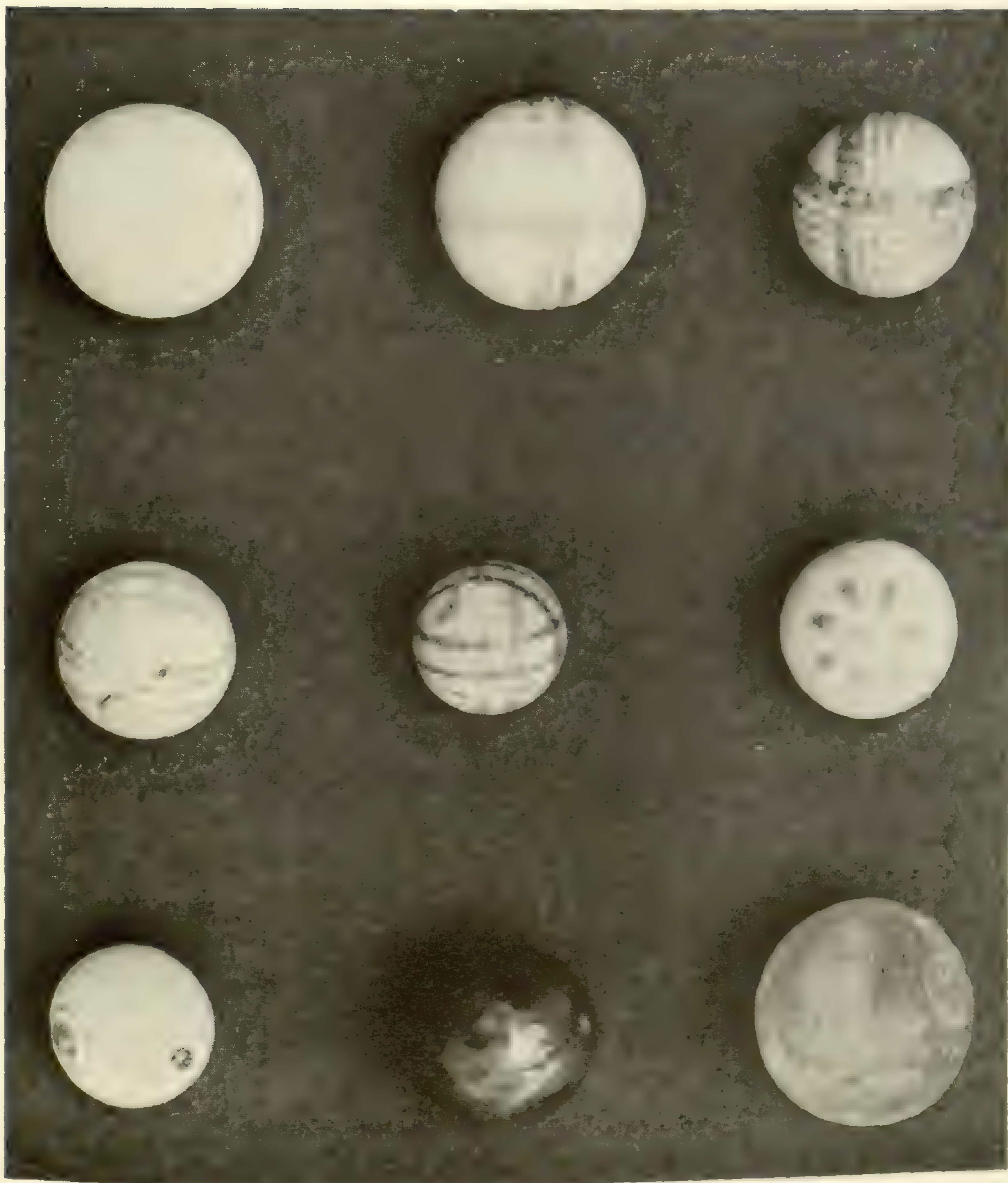


Plate 5: Marbles. The only glass specimen unearthed is the largest one at the lower right; the others are porcelain.

A tiddly winks or small counter was found. Made of pressed paper, it has a faded red surface color. The piece measures $\frac{3}{4}$ of an inch across. A tiny ($\frac{1}{4}$ inch) bone die is too small to have been suitable for serious gambling, but is similar to those used in playing board games such as pachisi.

A portion of the upper arm of a chinaware doll was unearthed. The arm has a dull white surface and is perforated for attachment to the doll's shoulder. It has a maximum diameter of $\frac{5}{8}$ of an inch. Another fragment, from a different, larger porcelain doll, has a flesh colored exterior and white interior. It was broken from the doll's neck region.

Approximately one-half of a much rusted, spoked wheel was found. It has a diameter of $1\frac{3}{4}$ inches, and is probably from a child's wheeled toy.

Medicines. A number of pieces of small rectangular bottles turned up during the excavation. Some of these probably contained patent or other medicines. They must have been provided with paper labels, none of which, unfortunately, have survived. As a

consequence, it is not possible to state what their original contents were. Two small tapering corks fit into bottles of this kind.

Also recovered were six metal caps from tubes of ointment. Three are hexagonal; two are octagonal; only one is circular. Trademarks on three caps are: "P" in a fancy script, "JB W Co" and "V Co" (?) in a flowing, intertwining script. Two necks of small tubes were also unearthed. A single composition screw cap was also found. A tin can, 1½ inches in diameter, contained a hardened cake of salve or other unguent.

Summary and Conclusions

Although historic objects taken from the earth in and around the Hugo Reid Adobe provide revealing glimpses into the manner of living of its former tenants, they by no means illustrate all of their activities. The excavation produced concrete evidence only for those aspects of life which were reflected in material things. And even here, the record was far from complete as many items have disappeared long ago without a trace.

Despite gaps in the archaeological record, certain facts stand out. One is that living conditions were simple with little in the way of elegance. Most items turned up by the digging were everyday necessities; few were luxury products. Evident also is that the pattern of life persisted with little change over the years, even during the ownership of Elias J. "Lucky" Baldwin, a man who liked to do things on a grand scale (Glasscock, 1935). Finally, it is apparent that the house's inhabitants were predominantly adult males as most of the articles recovered are those used primarily by men. Comparatively few are attributable directly to women and children.

Measured against the meager historical sources, the inferences based upon archaeological finds present a fairly accurate picture of daily life. Throughout its occupancy, the Hugo Reid Adobe served as headquarters for a vast ranch (Dakin 1956; Wallace 1958). In it were housed and fed the ranch foreman, perhaps his family, the cook, herders and laborers. During this period in California's history, hired hands were provided with few comforts and their life was hard and rough.

When the various articles were in use is a question which is difficult, in most cases, to answer. Because of the loose and upset nature of the debris, the depth at which a particular object was found provided no good indication of its age. Remodelings and other construction have caused much soil disturbance as has the burrowing of rodents. Striking evidence of this was provided by the fitting together an ironstone sherd retrieved in the first six inches of refuse with one secured at thirty inches. Since the time of the house's erection (1840) and the length of its effective use (until around 1910 except for caretakers) are known, most of the cultural materials must date from the period between 1840 and 1910. A few (e.g. the 1940 penny) are obviously recent intrusions. Others are "modern" to the extent that identical or similar items can be purchased today; many cannot be dated with certainty because they are either too generalized in form or too fragmentary. The majority appear to have accumulated during the final (post-1870) period of the house's occupation; some are older. A few objects such as the trigger guard, brittania spoon and Late Spode sherd would not be out of place in Hugo Reid's time.

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Hugh Evans, 1874-1960

VICTORIA PADILLA

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The great charm of our better Southern California gardens lies not so much in the profusion of bloom as in the rarity of their plantings. Visitors never cease to exclaim over the dazzling blankets of bougainvilleas that cover our walls, the gorgeous flowers of the hibiscus, the brilliance of the flowering eucalyptus, the odd coral blooms of erythrina and the powder puffs of the calliandra.

That our gardens partake of a tropical lushness that delights all who visit them is due in no small measure to the efforts of one man, Hugh Evans. Combining both vision and common sense, he was one of the first to realize that it was folly to attempt to raise in our subtropical climate the plants that grow in the East and the Midwest. Instead, he searched the world for unusual plants that would do well in our arid land, and in bringing them to our attention, he has left us forever in his debt.

A younger son, Hugh Evans left his native England when he was eighteen, in search of the opportunities that were denied him at home. He first resided in San Diego County, where he raised citrus. Always an ardent gardener, he was immediately enthusiastic over the possibilities of his adopted country. He found to his keen delight that many of the plants raised only in stove houses in England could be grown here outdoors the year round. He was particularly proud of his success with laelias and epidendrums, which he grew in hanging baskets under his trees.

In 1902, because of drought and a plague of rabbits and other pests which ruined his crops, Evans moved to Los Angeles. He purchased a nursery there, which he sold in 1905 to Theodore Payne. For several decades he forsook horticulture as a livelihood for insurance and real estate, but the love of plants remained the dominant force in his life. He planted a garden in Santa Monica that became world famous. Finally in 1935, when he could stand it no longer, Hugh Evans returned to the nursery business from which he retired in 1957 only because of failing health.

Our gardens would lose much of their glory if we should take from them the plants that Hugh Evans, in his wisdom, saw fit to introduce to Southern California. A list of his introductions—numbering into the hundreds—would be too long to write here, but many of the natives of Australia, New Zealand and South Africa that we grow were brought here by him. So much that is taken for granted—the flowering eucalyptus, the cassias, the grevilleas, the helianthemums, the banksias, the erythrinas—were his importations. To him we owe the presence in our gardens of such loved plants as *Ochna multiflora*, *Albelia schumannii*, *Aster fruticosus*, *Tibouchina semidecandra* var. *grandi-*



HUGH EVANS

flora, Chamaelaucium ciliatum, Calliandra inaequilatera, Bougainvillea "Barbara Karst," Baubinia galpini and Thunbergia gregori.

But aside from his contribution to horticulture, Hugh Evans will long be remembered as one of the great personalities, not only of the plant world, but of all Southern California. Blessed with a learned mind and an understanding heart, a keen wit and a great kindness, he was loved and respected by all who knew him. He was disdainful of all ignorance, pettiness, prejudice and sham. To him the tiniest rockery plant was as important as the tallest tree in his garden. Although his knowledge—classical, antiquarian, political, literary and horticultural—was amazing in its variety and its breadth, his outstanding characteristic was the generosity with which he shared that learning. No one with a sincere interest in plants ever left his nursery without the gift of a rare plant or two and a greater knowledge of the wonderful world of plants.

"Gardening," he was fond of saying, "has been well described as the purest of human pleasures and the most enduring of human pastimes. Without beauty, life is only a desert, and surely in these heavy and tragic times, men and women all over the world can derive a large measure of comfort and consolation from the contemplation of growing things, and from the peace and tranquility of their gardens. When I recall the golden hours I have spent over the years roaming among my plants, I can exclaim like the poet. Burns, *Still o'er these scenes my mem'ry wakes*

And fondly broods with miser care."

A Burning Test on Cistus Chaparral in Sicily

GUIDO LAURE, S. OIENI, P. ZINKE¹

Introduction

The chaparral of southern California is a valuable cover for steep mountain watersheds in that it lessens surface runoff and erosion during heavy winter storms and thus reduces the damage that might result from floods and sediment on the heavily populated valley lands below. A basic dilemma arises in that this cover also increases in fire hazard as it becomes dense and more effective as a watershed cover. Thus there is an interest in determining possible watershed cover plants of lower flammability than those now existing. This does not necessarily imply costly conversion of large areas, but most likely limited conversion of border strips and fire breaks around areas of heavy use.

Previous experience has indicated that some genera as *Eriodictyon*, *Mesembryanthemum*, and *Cistus* may include less flammable plants. Examples of this is the work conducted by Juhren (1956) with various species of *Cistus* and the burning experiments carried out at the Los Angeles State and County Arboretum (Martin and Juhren) during which experiments it was observed that *Cistus* shrubs burned slowly. However there are also references to the high flammability of *Cistus* under certain conditions. (Belaños and Lopez). They state that the Jaral (chaparral like stands of *Cistus*) is one of a group of the most inflammable vegetation types in the world, and at the same time the least resistant to fire. This inflammability is attributed to the surface resin coating on the leaves and it is said that the flames are carried rapidly into the crowns of the plants, totally killing them even when the stems are not burned. The Jaral survives fire because of the stimulation of seed germination brought about by the high temperatures or other conditions due to the fire as was observed by Martin and Juhren. Burcham (1957) in a report to the State Board of Forestry felt that more information was needed on the relative flammability of *Cistus* as a vegetation type since our native chaparral also contains some species of less flammability (*Rhus laurina*, *ovata*, and *integrifolia* as well as some of the *Artostaphylos* species).

These conflicting facts and opinions indicated that it would be useful to test the flammability of *Cistus* plants under field conditions in which the *Cistus* shrubs and associated species were mature. Adequate determination of the fire resistance of mature *Cistus* plants has not been possible in California since they are not available under conditions of natural cover. It is apparent that such conditions are present in Sicily for certain species of *Cistus*, and a cooperative study was arranged between the Italian Forest and Reforestation Administration, Provincial Department of Palermo, Region of Sicily; and the University of California, Department of Forestry, with support from the Foundation for American Resource Management.

The burning tests were conducted in Sicily on the Carbone Regional Forest in the Commune of Gratteri south of Palermo. The location of Sotto Gallina was near the top of a ridge at an elevation of 700 meters above sea level with a north northeast exposure. The vegetation was typical Mediterranean macchia (similar to California chaparral) consisting mainly of three genera. *Cistus*, 60%; *Calycotome*, 30%; and *Ampelodesma*, 10%. The major species were *Cistus monspeliensis* L, *Cistus albidus* L, *Cistus salvifolius* L, *Calycotome spinosa* Lk, and *Ampelodesma tenax* Lk. There were also occasional

¹Respectively. Research Fellow, Univ. of California, School of Forestry, now Assistant Director of Regional Forests of Sicily, Palermo; Member of the Staff of the Departmental Inspector of Palermo forests; Assistant Professor of Forestry, Univ. of California, Berkeley.

Figure 1. General view of the experimental plots. Plots Number One to Four beginning at right. Plot Three has just been burned.

Figure 2. Detail of the typical Mediterranean macchia (chaparral) in which the tests were conducted, with a group of *Cistus monospeiensis* shrubs on the left.

Figure 3. Close view of Plot Number One showing dense cover two to three meters in height.

Figure 4. Detail of Plot Number One with clump of *Cistus monospeiensis* in center.

Figure 5. Fuel structure of *Cistus monospeiensis*. A relative lack of dead wood is apparent.

Figure 6. Plot Number One during fire.

Figure 7. Plot Number One following fire from point corresponding to Figure 3. Not incomplete burning of *Cistus* foliage.

Figure 8. Plot Number Two before firing, showing the vegetation composition of *Cistus monospeiensis* and *Ampelodesma tenax*.

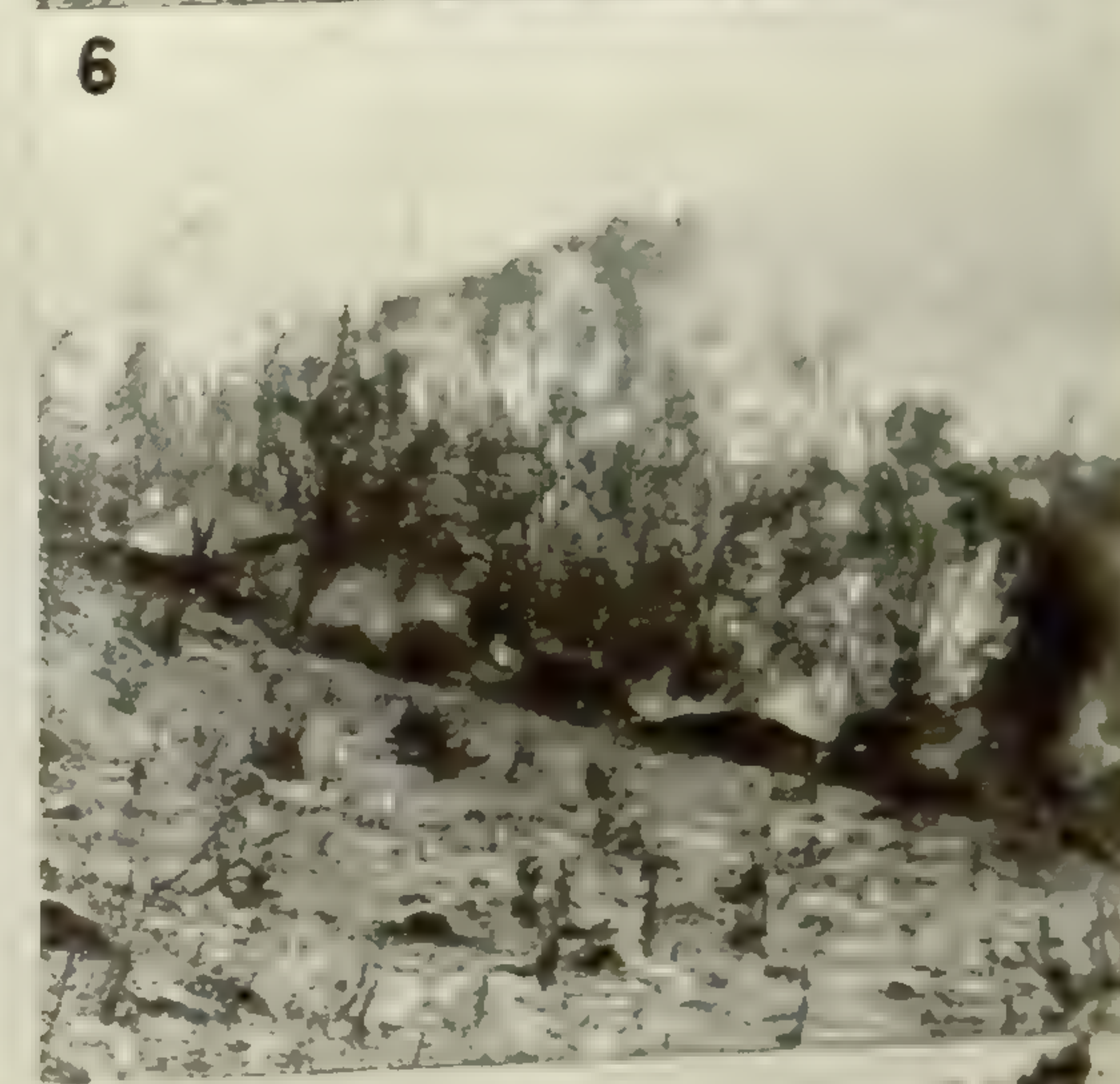
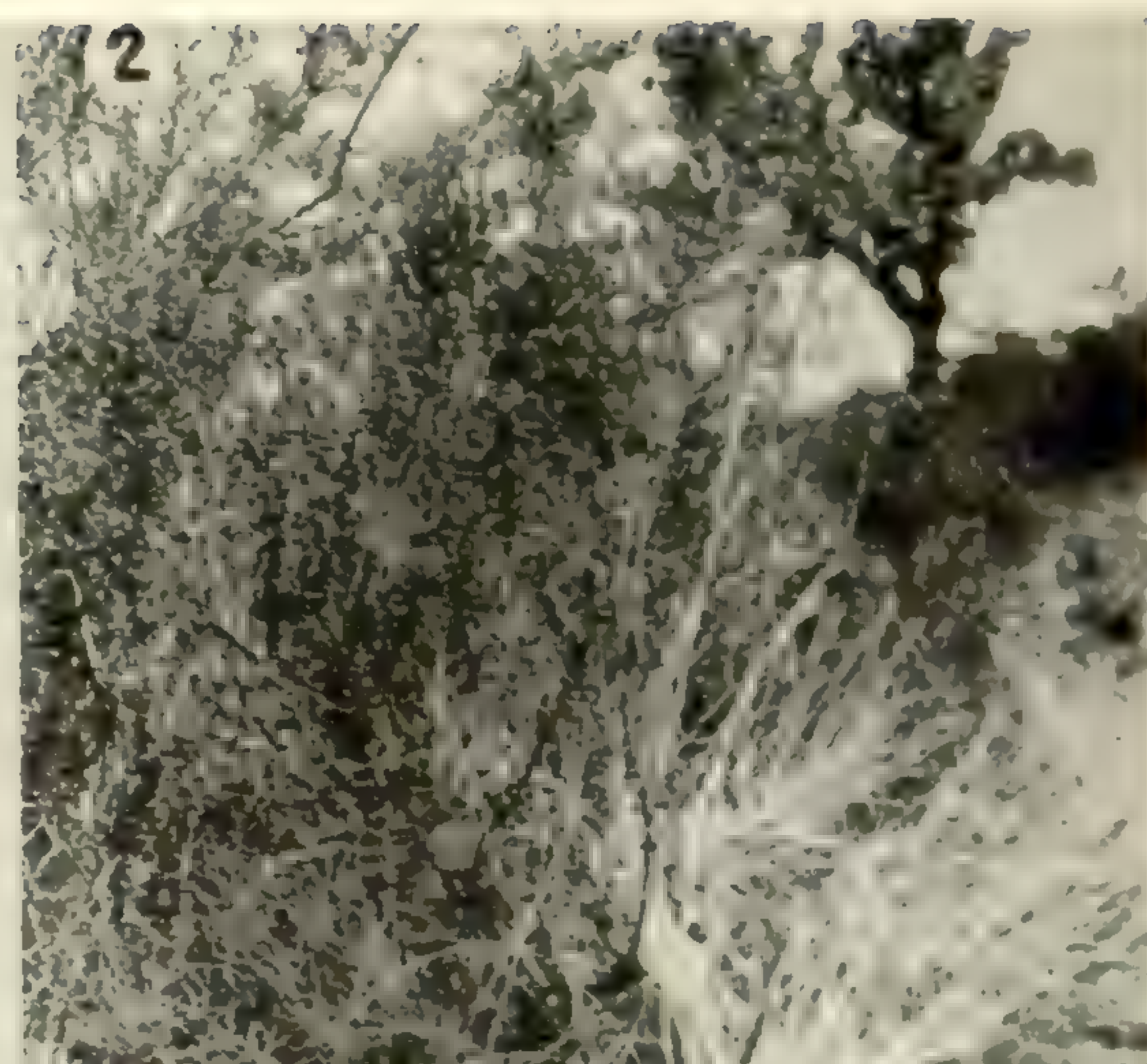
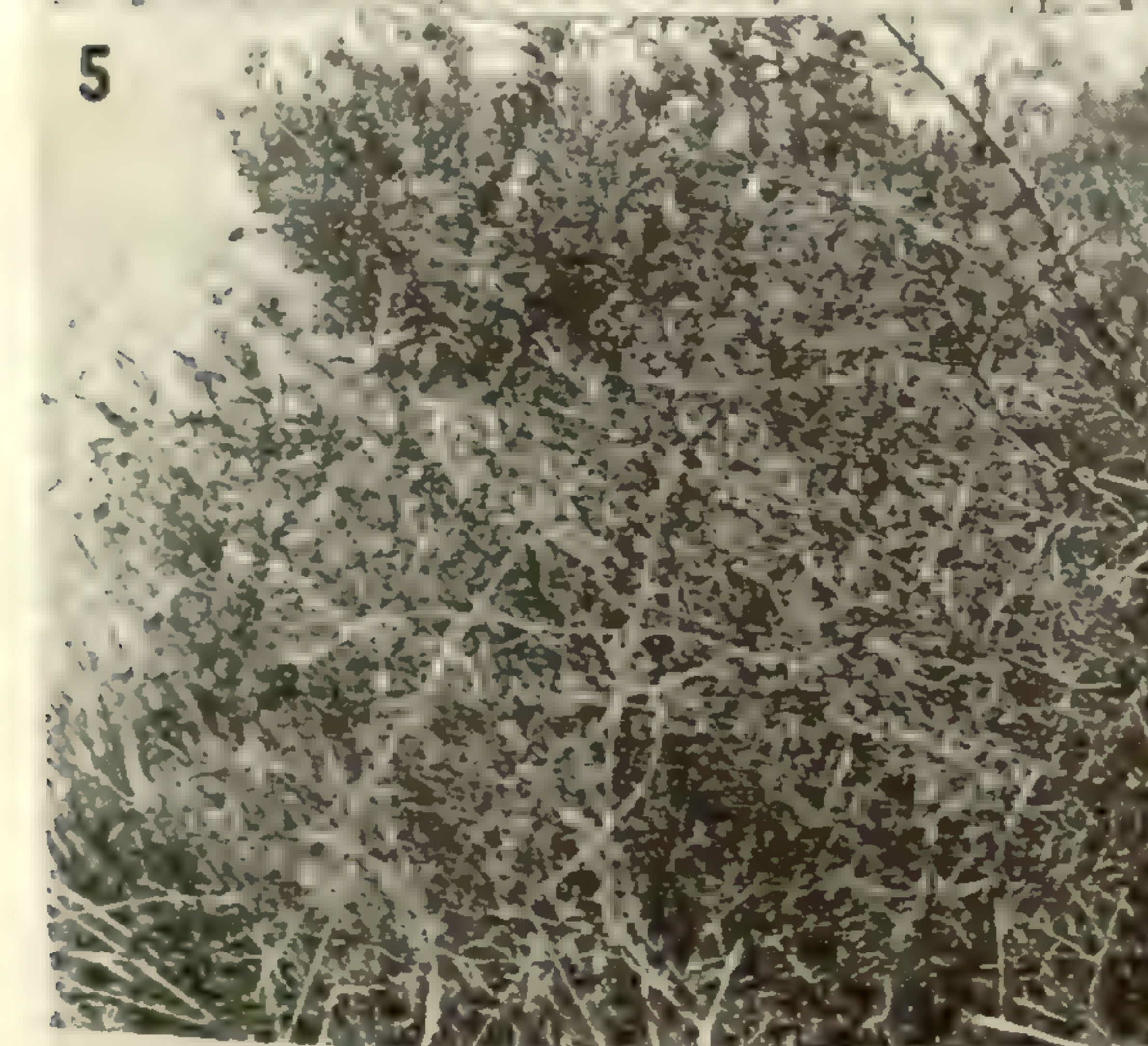


Figure 9. Plot Number Two during fire.

Figure 10. Plot Number Two following fire, again showing unburned leaves in the *Cistus* shrubs.

Figure 11. General view of Plot Number Three before firing.

Figure 12. Detail of portion of Plot Three before firing. A low cover of *Ampelodesma* is on the left, a single wild pear *Pyrus* is the tallest plant, a low clump of *Cistus monospeiensis* and a tall individual *Genista* is seen.

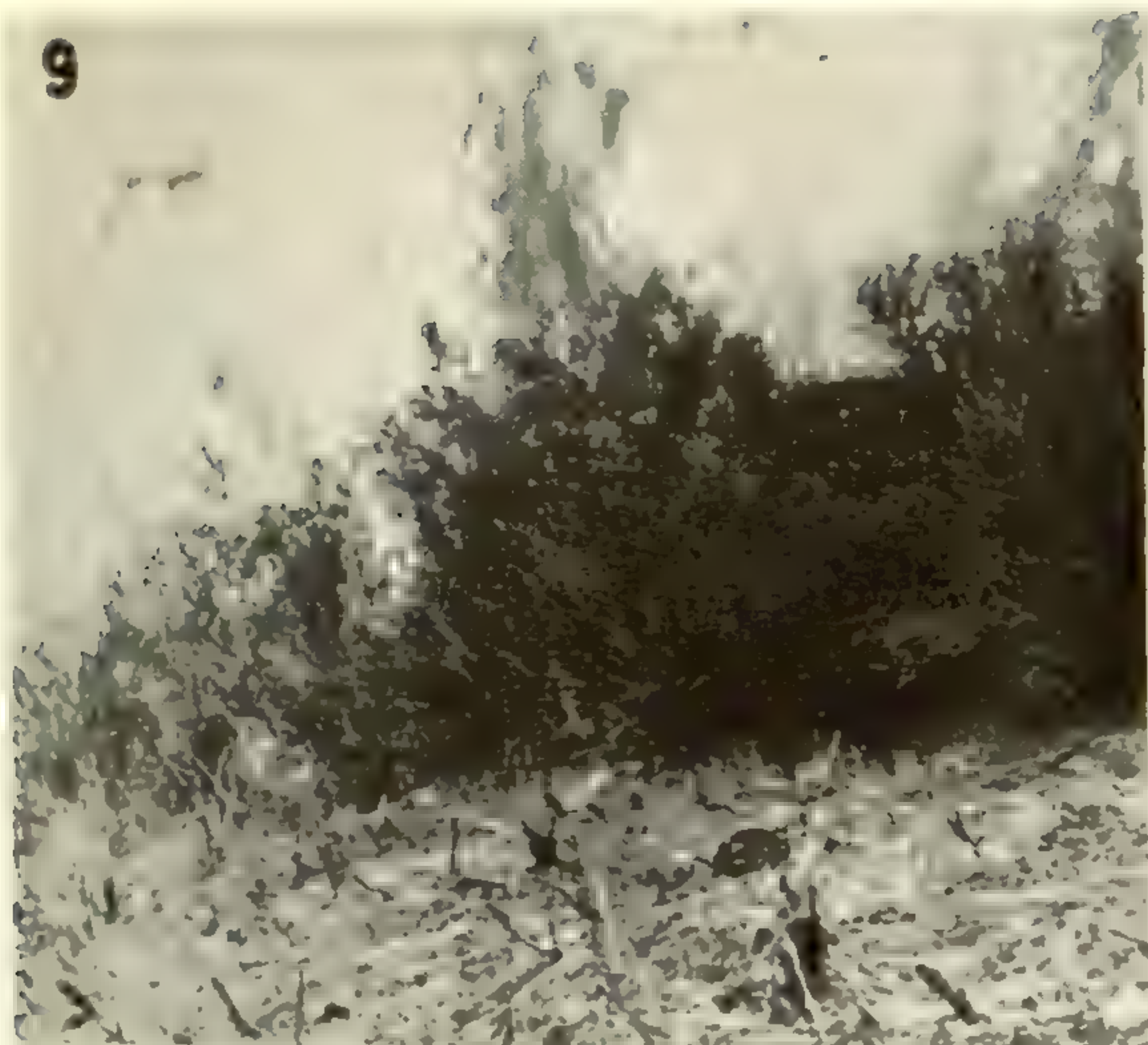
Figure 13. The portion of Plot Number Three shown in Figure 12 after the fire. Note that the low *Cistus* between the tall wild pear and *Genista* shrubs had a more complete burn of the foliage than had occurred in plots One and Two.

Figure 14. General view of Plot Number Four with *Ampelodesma tenax*, *Calycotome*, wild pear and a group of *Cistus* on the right.

Figure 15. The same portion of Plot Four as seen in Figure 14 following the fire. Note the unburned *Cistus* group.

Figure 16. General view of Plot Four immediately following the fire. A high proportion of the unburned foliage is *Cistus*.

9



10



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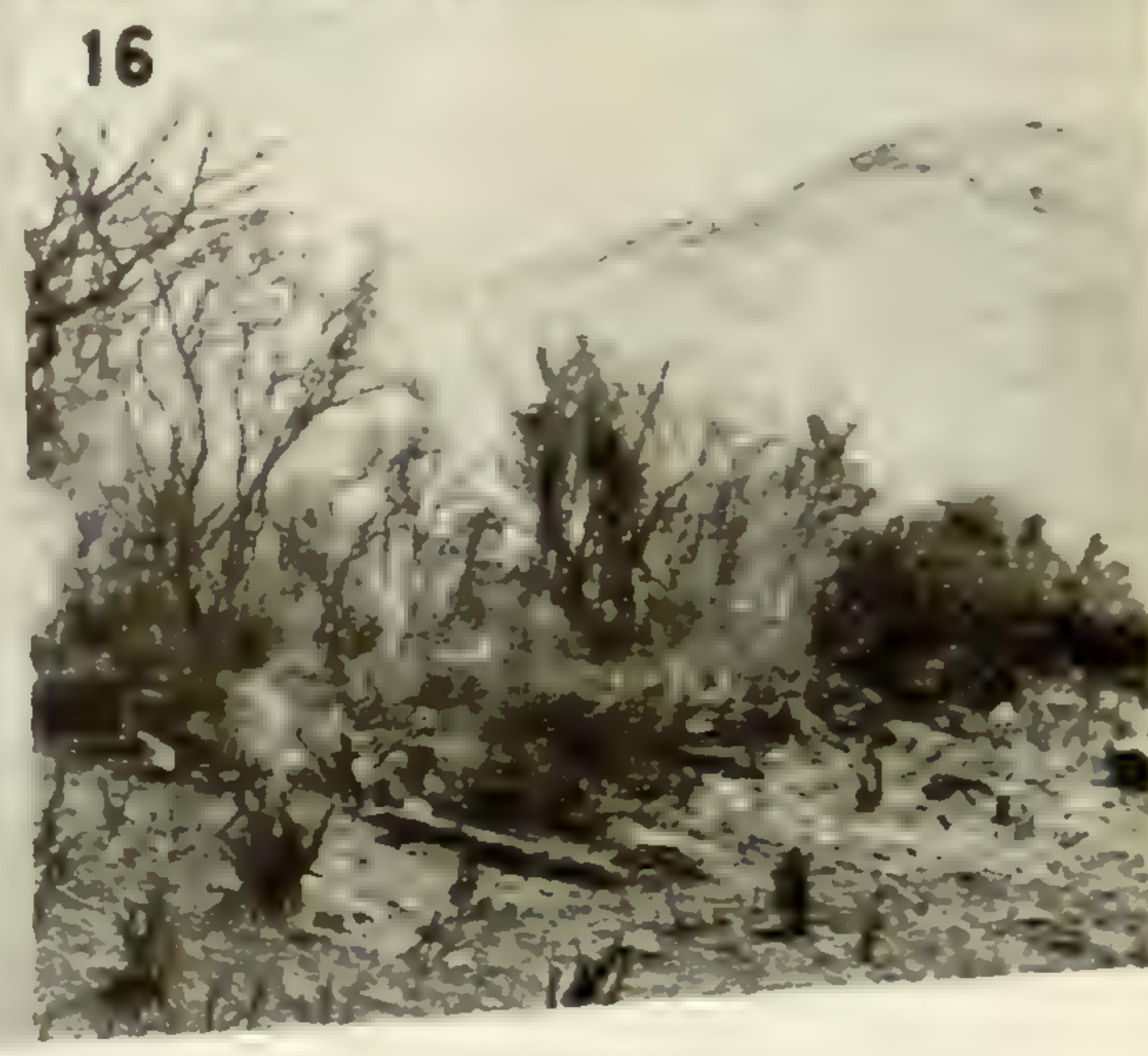
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16



individuals of other genera as *Genista*, and *Pirus*. The stands were fully stocked as can be seen in Figure 1. The vegetation was from one to two meters high. There was a light covering of leaf litter on the ground from the main species present. The soil was a rocky colluvial soil at the bottom of a long slope. The degree of slope was approximately 25%.

The climate at the area of the test is typified by a long dry summer. An example of the climate is given by that at Ciminna (Pavari, 1936) to the east at an elevation of 500 meters (1640'). There the average annual precipitation is 666 mm (26.2"), the average annual temperature is 14.3°C, (59°F) with a mean maximum of 29.2°C (85°F) and a mean minimum of 5.6°C (42°F). These are climatic conditions which would also typify the foothills of the San Gabriel Mountains in southern California. At the time of the test (July 13, 1957) the temperature was slightly above 90°F at midday with a shifting north wind. There were no clouds. The areas burned were in the form of 10 x 10 meter plots (100 square meters—1,076 sq. ft.). These were cut out of the dense stand of macchia. Each plot was ignited around the periphery. The four plots can be seen in Figure 1. Two plots, numbers one and two, were burned at 8:00 a.m.; and two plots, numbers three and four, were burned at 1:00 p.m.

The observations made during the test and substantiated in part by the photographs indicated that under the conditions of the test there was relatively less flammability exhibited by the *Cistus* than by the other shrubs present. Generally the fire was not hot enough to consume all of the stem material, and much of this remained. Shrubs of *Cistus* were present in all the plots (Figures 4 and 5). The occurrence of the *Cistus* shrubs was mainly as groups among other shrubs (Figure 5). The flames were attenuated when they reached these groups of *Cistus* during the burning. Following the fire it was noted that the leaves of the *Cistus* shrubs had not burned as readily as those of the other shrubs and were consumed mainly where the other shrubs had closed in on the *Cistus* shrubs.

Discussion

The results from this study are somewhat at odds with the statements that *Cistus* Chaparral (Jaral) is very inflammable (Bolaños and Lopez), but tend to support previous work (Martin and Juhren) that under certain circumstances some species of *Cistus* may be relatively less flammable than other chaparral species. A possible clue to the reasons for differences in observations may be in a trend in moisture content of the *Cistus* resulting in variable response under one set of conditions compared with another. Olsen (1960) has presented data showing that in the early part of the year, *Cistus purpureus* has much more moisture content than *Adenostoma fasciculatum*, but that as the summer progresses the moisture contents tend to become similar. The mature *Cistus* in the present study definitely seemed to have lower flammability than the associated shrubs at the location of the burn.

Summary

Burning tests conducted on mature macchia vegetation in Sicily containing a large proportion of shrubs of the genus *Cistus* indicated that there was a lesser flammability of the *Cistus* shrubs under the conditions of the test relative to flammability of the other shrubs present.

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Freeway Planting and Maintenance in California

H. DANA BOWERS

The author is the Supervising Landscape Architect, State Division of Highways. This paper was presented at a meeting of the members of Los Angeles Beautiful Committee, July, 1961.

It would seem appropriate at this time to give you a little of the background leading up to our present freeway planting and maintenance program.

Roadside planting was officially begun in 1917 when the Highway Commission voted to accept the maintenance of roadside trees which prior to that time had been planted by civic or private initiative practically at will. These trees were obtained principally from a nursery established for that purpose. Since the main thought in mind was to plant as many trees as possible, little or no attention was given to the adaptability of varieties or to their future maintenance, it being assumed that approximately three years of watering from a tank truck would see the trees established. In but very few cases did this assumption prove correct, and in several, the watering operations were required for twelve years, with a total growth of a little over as many feet. Very few plantings were made where climatic conditions were favorable to rapid establishment, for in those areas shade was not a consideration and planting for aesthetic effects was so far a minor issue. Little thought was given to future traffic demands or the ultimate development of rights of way as it might affect the trees. It is easy to understand why, in those pioneer days, such future growth in our population and its demands were unpredictable. Nevertheless, the results of this lack of foresight were to be observed during the necessary widening operations on practically all the roads where trees were planted. Many fine old trees were destroyed to allow space for wider pavements.

This planting program progressed with such vigor that it soon became apparent that a curtailment was imperative, in order to keep the cost of even the three years' maintenance within bounds. It also became clear that a definite policy in connection with planting standards were necessary. These were worked out in 1927, prohibiting any planting on less than an 80-foot right of way. Ultimate development widths were determined for rights of way varying from 80 to 200 feet in width. Locations of all plantings and public utilities were designated and all had to conform to those standards, although little planting was done on 80-foot rights of way at the 33-feet-from-center standard, as this was entirely too close to the traveled way for trees.

Very little, if any, consideration was given to the development of roadsides, except tree planting, until about 1930. A survey of roadside trees on the State Highway system was made in the winter of 1930-31 and it was found we had a total of 60,245 trees that had been planted, most of which were under maintenance. Of this total, 3117 were in District VII with Headquarters here in Los Angeles. At that time this District included all the territory between Los Angeles and the Mexican border.

About 1933, with the advent of W.P.A., hand labor projects were much in demand. As a result many lookout points, drinking fountains, and what is now similar to "roadside rest" areas were constructed. Also, many plantings were made that otherwise could not have been undertaken, because of lack of Highway funds. The Arroyo Seco Parkway, Cahuenga Pass, through Santa Barbara and the Santa Monica Bluffs are examples of plantings by W.P.A.

During the war years, our Engineers were busy preparing plans for freeways. The

Santa Ana and Hollywood Freeways and the Cabrillo Parkway through Balboa Park in San Diego were among the first full freeways to be planted, and from then on they have been coming thick and fast.

Needless to say, the landscape treatment of freeways with their cut and fill slopes, and the irregular shaped areas involved in the complicated traffic interchanges, presented problems that were a far cry from the usual row planting of roadside trees.

Our experiments with slope planting on the Arroyo Seco Parkway were most valuable. Almost 30 varieties of prostrate type plants had been tried on those slopes and as a result we had at least arrived at some definite conclusions concerning the stabilizing value of various so called ground covers, which by reason of the extensive slopes to be covered on future projects were of primary importance.

Our close observations, over the years, of all varieties of plants under various conditions, throughout the State began to pay off, for there again we at least knew that certain plants would not serve our purpose.

Since 1930, plants of any variety that appeared to be useful for roadsides have been planted under all possible conditions, and if the plants were not available, seeds or cuttings were gathered and propagated. The potential of every native and every available exotic has been explored in a sincere effort to produce desirable effects with a minimum of maintenance.

Plants for highway use must be as near to fool proof as possible. They must withstand the greasy film generated by high traffic volumes, must cover the ground to eliminate weeds and fire hazards, must grow uniform and dense without constant pruning and require a minimum of water. Plants with pubescent leaves are useless close to the traffic lanes. They gather the dirt and grease, turn black, become unsightly and eventually die. Plants with glabrous, and preferably light green leaves accumulate less dirt, and can be washed clean. We favor the varieties with light green leaves for they create cooler and more pleasing effects.

Plants that thrive in hot arid areas but under natural conditions, and seemingly would be ideal for sterile roadside slopes, are seldom successful close to the traveled way. The effect of prevailing winds, which carry the gases and oily film from the cars, can be observed on many freeway plantings.

Many of you will recall the grass originally planted in the median strip on the Hollywood Freeway. As the traffic increased the grass disappeared until only a few deep rooted perennial weeds remained. Working conditions became intolerable, it being close to suicide to perform routine maintenance.

These changed conditions resulted in removal of the grass. This was replaced by paving and with plant boxes at intervals, which were mainly traffic delineation. Eventually these became impractical to maintain and repair and are being replaced by the median barrier rail.

It must be understood that regardless of the variety of plant used on heavily traveled freeways in areas of dense population, water must be made available, for two reasons: 1st, primarily for the prevention of fire hazard, and 2nd, for establishment and washing off of the plants.

Although many natives will live without watering, the fact still remains that occasional waterings improve their appearance and hasten their spread to cover the ground.

Most of our planting is actually a necessity. Without irrigated shrubs or evergreen ground covers, the grasses would have to be allowed to remain to protect the slopes against erosion and during the dry season these grasses would constitute a serious fire hazard.

Since we must plant *out* the fire hazard, and since we must water, we endeavor to select plants for their aesthetic values as well as for the service they may render.

Some plants have high aesthetic value, but are of no value as a cover. Bougainvillea

and climbing roses are two examples. Their arching habit of growth allows the development of weeds and grasses beneath, which, if not kept green, become a fire hazard.

Climatic changes have effected our planting. In the early 30's Eucalyptus and Ice Plant could be planted from Salinas to San Diego with no concern of watering costs. This has not been possible for years in Southern California. Note the Eucalyptus and Ice Plant planted several years ago on the Santa Ana Freeway. Practically a complete failure. I have recommended no more Ice Plant projects until seasonal conditions return to normal, if ever. If they don't, we will have to use increasingly precious water to keep the cheapest and the most practical ground cover available alive.

Over the years of experimentation in the selection of plants for roadside use, comparatively few have remained on our preferred list. It is difficult to find many plants that are long lived, rapid of growth, attractive and adaptable.

There was a time when I regarded anyone with scorn that even suggested the use of an exotic. Close association with Mr. Theo. Payne was directly responsible. Of my most treasured memories over the past 30 years, the days spent with Mr. Payne on field trips or discussing the use of California's own plants, will never be forgotten. I consider myself fortunate indeed to have had the honor and the privilege to know such a dedicated gentleman. In those days before the great migration to California and subsequent smog, our natural landscape was beautiful and a native plant could be found for most any purpose or condition. Natives or nothing was my motto and I stuck to it until we began building freeways through our cities. Here was a problem of stabilization as well as "beautification". Also, many of the cut slopes were 1:1 which is twice as steep as they are today. Obviously, shrubbery on these slopes was not the answer. Dense covers were required that would root vigorously and form a thatch over the slopes shedding the water, and tying the soil together.

Every plant available, that crept, crawled or lay flat was planted on the Arroyo Seco Parkway. Only one proved practical over the years and that was the English Ivy. It provides perfect slope protection and weed control as well as a neat and attractive appearance. Honeysuckle grew well and served the purpose, but was a continual fire hazard. It could be watered in the morning and would burn in the afternoon. A favorite form of amusement for the fire bugs was to place a lighted cigarette in a package of paper matches and throw it on the slope. The fire performed an excellent job of pruning since the honeysuckle grew back from the roots rapidly, but the method was unsightly and the smoke was hazardous to traffic.

So over the years, as a result of observation, trial and error, we have arrived at a limited number of plant varieties that we feel produce the most for *your* money and we are constantly searching for more. Unfortunately, by reason of the large quantities required to cover the vast acreage to be planted, and the seemingly perpetual shortage of plants, we have used some varieties in our mixed shrubs and mixed trees that have not been too satisfactory. Such plants of course are scratched off the list.

The advantage of mixed plants is the variety and color produced in the final effect. Also, as soil, drainage and exposures can affect the growth of plants, by mixing the varieties, adverse conditions will affect a minimum number and not the entire mass as if only one variety was used. It is often impossible to obtain more than a few hundred of any variety from commercial nurseries. Therefore, several varieties simplifies the problem of procurement for the landscape contractor.

When large quantities of trees, shrubs or ground cover are needed, we estimate in advance the required quantity and arrange for their propagation and delivery. This is done about one year in advance of advertising the project for planting contract. As many as 30,000 of a single variety of plant has been ordered grown for one job. These plants are specified for use on the projects as State-furnished material.

In the selection of plants for freeway planting, of paramount importance is the subsequent maintenance. Actually, both in selection and design, we must start with mainten-

ance and work backwards. A complete planting with a sprinkling system averages about \$7500 per acre. But this is only the first cost. From then on constant care is required which amounts to some \$1,000 per acre for the first years of establishment and complete cover. After that, costs can be reduced about one-half under normal conditions. You may be interested to know that we estimate approximately 10% of a gardener's time is spent picking up beer cans and other types of litter.

Some of our most costly projects to maintain are those where every effort was made to hold the original planting cost to a minimum. There is no economy in trying to be economical with plants. The cheapest method in the long run is to give the plant every advantage so that it may send its roots deep into the ground as quickly as possible. This is difficult to do on some of our freeway fills that are compacted so hard as to require power equipment to break up small areas of sub-soil in which to plant.

Now this discussion of plant selection could go on indefinitely. I know of no subject where opinions differ as widely. Old Mother Nature saw to it that there would be no monotony in her household, by refusing to repeat anything, anywhere. So consequently, few people agree as to the all around merits of any one plant; they may agree there are some plants we could get along without—like Bermuda grass or Poison Oak—but since conditions and results are so variable, it is impossible for everyone to see eye to eye.

But we do agree that plants are essential to our very lives. It remains then only to determine how many plants can we afford?

This question has been the subject of serious discussions within the Division of Highways for over 30 years.

In line with your concern in connection with the cost of maintaining freeway planting, we have been likewise concerned. In 1944 I prepared and presented a paper before the Roadside Development Section of the A.A.S.H.O. It was entitled "What Expense is Justified for the Aesthetic Treatment of Parkways?"

I would like to quote from portions of that paper at this time to make clear to you we have recognized for many years the problems and the expense involved in roadside development, and to illustrate the trend of the thinking in that regard of some 20 years ago. I quote:

"Post-War plans contemplate the construction of several types of roadways. Among them are Freeways or Parkways which, in my opinion, merit immediate concern. Experience with the landscaping of our first Freeway has revealed the high cost involved in the installation and maintenance.

"In determining the practical limits to which Freeway landscaping can be extended, it might be in order to first classify the various Freeway locations as to probable landscape requirements. As an example, a Freeway connecting two Cities could comprise three classifications: urban, suburban and rural. Each would have a separate landscape requirement.

"We know that soil stabilization and erosion control has a definite economic value and expenditures for this purpose can easily be justified. The justification for expenditures to create and maintain aesthetic values however, is a debatable question, and one that has often been a subject for debate. With the advent of post-war Freeway construction with wide rights of way and large areas at traffic interchanges, there will naturally follow demands from Civic organizations for aesthetic treatment. These demands, sometimes impractical, would be much simpler to reason with, if the States as a whole could adopt some practical planting design standard or policy concerning the various general conditions or classifications.

"It would seem that one approach to the problem would be to define landscape requirements. We cannot say that these requirements are merely matters of opinion. In order to justify a continuous program and to prevent criticism outside the organization as well as from within we should be able to show a profit, as it were, on the investment.

"Aside from the fact that things should look well, even roadsides; assuming we have

all the Garden Clubs, advocates of beauty, and "down with the billboards" groups to champion our cause, the public in general and Engineers in particular do not always appreciate seeing money expended merely to improve appearances. When such expenditures are questioned, it would be well to be able to show the potential savings either in dollars and cents or aesthetic values that could result from planting. It is up to us, therefore, to produce.

"Arguments in favor of aesthetic treatment are the abatement of traffic noises and the restoration of privacy of adjacent homes through vegetative screening. Sound and sight can be effectively reduced and screened off with plants.

"There is a considerable difference in the cost of treating some 6 acres per mile on 100 feet of right of way as against some 20 acres per mile on a metropolitan freeway. The purchase of right of way through cities cannot always be confined to the minimum width required for the roadway. Entire lots along with improvements thereon must be acquired and often that portion of such parcels not needed for the highway, have little or no value for residential or commercial use. The problem of their treatment and maintenance then follows.

"In California we can always depend on two things, dry summers and dry weeds and grasses. These present a serious fire hazard that obviously must be controlled in some manner. They also present an unsightly appearance particularly through well kept urban and suburban areas where the contrast is not a pleasing one. That brings us back to the question: How much of an expenditure can be economically justified for the aesthetic treatment and maintenance of Parkways?

"This question may not register as particularly important with some of you Easterners, so fortunate as to be blessed with natural overhead irrigation, but in the Western States, it is a number one problem.

"For example, our Arroyo-Seco Parkway between Los Angeles and Pasadena, 7 miles in length, costs \$22,000 per year or an excess of \$3,000 per mile per year for maintenance (this was in 1944). This entire area is planted to various ground covers, trees and shrubs, and is all under sprinkling system. We have no ground cover sufficiently drought resistant for inland use, to maintain a green cover throughout the summer season that will compete with the natural weeds and grasses. Native, indigenous material will provide suitable screen plantings without irrigation, but the problem of fire hazard beneath and between these plantings still remain. We cannot seem to adopt half way measures in our planting and still produce an attractive effect, appropriate to, and necessary through urban or suburban areas.

"A freeway should be treated and maintained commensurate with the adjoining type of development. Its benefit and enjoyment to the traveling public, while desirable, should not be of first consideration.

Plans for such treatment now prepared for post war projects are estimated at some \$100,000 per mile. Where planting is to be done, it is more economical in the long run to give every consideration to the preparation of the soil. The first cost is seldom criticized, if the results are satisfactory. However, curtailment on installation invariably results in prolonged excessive maintenance. This is an excellent manner in which to retard the progress of Roadside Development, since to many highway engineers, landscaping is still to be tolerated rather than encouraged."

Incidentally, on June 1, 1957, the Legislature adopted Assembly Concurrent Resolution #132, which reads in part as follows:

"WHEREAS, the Legislature in said Resolution made certain findings, including findings that 'Expenditures for landscaping and for design that enhances the attractiveness of highways are legitimate highway purposes for which the motor traveling public' may properly be expected to pay, and that increased public acceptance of California's freeway program will be encouraged by attractive design and appropriate landscaping of freeways; and

WHEREAS, the Legislature, in said Resolution, further expressed its purpose 'to inform the Highway Commission, the Department of Public Works, the State Highway Engineer, and the public generally, that the Legislature intends that a moderate increase in landscaping and other aspects of attractive design *appropriate to conditions in this State* be regarded as integral features of California's freeway program."

I thank you sincerely for your kind attention and I want you all to know that I truly appreciate the opportunity of appearing before you. I trust I have thrown some light on the steps we have taken, and are still taking, toward the aesthetic enhancement of a freeway system, second to none, in a State that is second to none. It is a big job—and getting bigger by the day. It is a costly job and costs are rapidly increasing. We cannot expect to create a Parkway effect on all of the freeways, even within our metropolitan areas unless money and water become unlimited. Water is of particular importance. By reason of the drought we are now suffering, and the fact that the State has been declared a disaster area because of the drought, we have carefully analyzed the entire proposed 1962-63 planting program and have postponed all projects not heavily bordered with homes or business where the control of fire hazard is essential. I feel we would be remiss in the responsibility incumbent upon us as servants of the people if we failed to recognize the present climatic problem.

As a representative of the Division of Highways, I sincerely hope you concur. I thank you.

Maintenance of Freeway Plantings

WILLIAM H. ARMSTRONG

The author is a Highway Landscape Supervisor, Division of Highways, State of California. This paper was presented at a meeting of the members of Los Angeles Beautiful Committee, July, 1961.

Mr. Bowers has explained how we justify planting specific areas and what determines the cost and scope of a planting. The second object of this meeting then is concerned with the maintenance of these plantings after they have been designed and planted.

It is our objective, once we have received a planting for maintenance, to attain the end for which the planting was designed, as rapidly and inexpensively as possible.

The degree of maintenance is predetermined primarily by the type of planting, the adjacent property and the type and speed of traffic. For instance, a fully landscaped area through an expensive residential zone would require a higher degree of maintenance than a functional planting in a rural area. Pedestrian and low speed auto traffic areas require more detail care than would a high speed freeway.

The maintenance methods and costs are dependent upon many conditions. Cost especially vary according to the climate, the type of plant material used, the grade of the slopes, the availability and cost of water, the proximity to other planted areas, and to special problems such as: insects, diseases, rodents, weeds, fires, litter, traffic control and accidents.

In recent years, maintenance costs have been reduced by improved designing and the use of many drought-resistant plants. Trees, shrubs, and ground cover are well watered and fertilized for the first two years to get them well established and effective. As the planting matures and accomplishes its purpose, maintenance is reduced and a portion of the personnel is shifted to other jobs.

The location of a new planting in relation to established plantings may increase or decrease the per-acre cost of maintenance. Plantings which are some distance apart must be treated as separate areas; whereas, plantings close together may be treated as one area in which men and equipment may be combined and in most cases would cost less to maintain. Small scattered plantings which require constant care are higher in per-acre maintenance costs.



Tall grasses used as highway border planting. Photo data: Date 4/7/60; Neg. No. 7434-1; District IV; County—S.M.; Route 68. Planting Peninsular Ave. OC--N. State of California.



To stabilize this bank, pines and grass cover were successful. Photo data: Date 4/6/60; Neg. No. 7427-11; District IV; Santa Cruz County; Route 56. State of California.

It is the desire of all concerned, to locate the ideal plant for highway planting purposes. This plant must have a dense growing habit with an abundance of low limbs to cover the earth and reduce weed and fire problems. It must be able to eliminate headlight glare and reduce the amount of dust and noise for the adjacent resident. It must be attractive so its presence will not reduce the value of adjacent property or annoy the passing motorist. It must grow fast enough to make a quick effect, but stop growing when it has accomplished its intended purpose; otherwise, it becomes a costly pruning problem. This ideal plant must be drought-resistant, disease and insect free, require no special nutrients, and it must have all these sterling qualities with roots growing in rocky or sterile soil which has been compacted adequately for a road base.

Needless to say, this ideal plant has not been found, nor will it be. However, the search continues, and many of the desired qualities exist in plants being used or tested.

Too frequently, the ideal plant today becomes a problem at a later date when its increased numbers make it an inviting host to some heretofore unheard of insect or disease. Varieties of Acacias at one time approached the ideal plant for our purposes, but considerable time and money is presently spent on controlling a New Zealand insect which arrived several years ago, and is now found state-wide on all our Acacia plantings. Eucalyptus in its many desirable varieties look like the nearest thing to the ideal plant, but even then, they suffer from insect damage in western Australia, and it is only a matter of time until we share this problem. Baccharis, which grows almost everywhere in California, looks good in its native habitat, but when planted on a freeway, it required watering, spraying for insect control, and created an allergy problem to adjacent neighbors when it bloomed.

During the 1959-60 fiscal year \$1,270,000.00 was spent to maintain trees and landscaped areas in this district, which includes Los Angeles, Orange, and Ventura Counties, with the majority of this being spent in Los Angeles County.

It is difficult, if not impossible, to get accurate figures on certain areas, inasmuch as new plantings are frequently maintained by the same crew as has been maintaining an adjacent older planting and the costs are not separated. However, accurate costs are available on specific areas with which many of you are familiar.

In Pomona, where the landscape planting consists of 50.2 acres of trees and shrubs entirely under a sprinkling system, the annual cost is \$882.00 per acre after the planting has become established.

On the Harbor Freeway, where the planting consists of trees, shrubs, ivy, and ice plant, entirely under a sprinkling system, the annual per acre-cost is \$1,530.00.

On the Foothill Freeway, where 10 acres of native or drought-resistant trees and shrubs have been planted and watered entirely by tank truck, the cost for establishing this planting has been \$1,790.00 per acre. However, this type of planting has comparably low maintenance cost once it has been established. What watering is done there at the present time, is done chiefly to wash traffic dust from the foliage.

On the Pasadena Freeway, our oldest freeway planting, 46 acres of trees, shrubs, and ground covers, all under a sprinkling system, cost \$1,740.00 per acre to maintain. In this area, traffic control adds greatly to the maintenance costs, due to the lack of working space for our crews. It should be remembered also, that in an older planting such as this one, tree trimming, plumbing repair, and restoration planting cause the maintenance costs to rise after they had been lowered for a number of years.

On the Santa Ana Freeway, 30 acres of functional planting consisting of ice plant, scattered trees, and a screen planting of Eucalyptus trees, cost \$504.00 per acre, with the occasional watering being done by tank truck. Here too, drought-resistant plants have been used and an occasional foliar bath is as important to the health of the plant as is irrigation.

On the Hollywood Freeway, it is estimated that established ivy slopes with scattered



Bank and fill stabilization. Photo data: Date 4/5/60; Neg. No. 7429-2; District IV; County SOL; Route 7. Slopes at Carquinez. State of California



A curving over-pass approach is beautiful by interspersing tall trees with medium height shrubs. Photo data: Date 4/7/60; Neg. No. 7430-11; District IV; San Mateo County; Route 68. Plantings San Francisco Airport intersection. State of California.

trees and a shrub screen costs between \$1,300.00 and \$1,400.00 per acre to maintain.

At the present time there are in this district 918 acres of landscaped freeways, averaging 12 acres per mile, and 546 acres of functional plantings averaging 10 acres per mile.

So that adequate and attractive highway landscaping may continue, you people, through our mutual interest, are here to help control the cost of both the planting and the maintenance of these plantings. Suggestions for your part in accomplishing this purpose are:

1. Reduce litter. This cost alone during the past year was \$1,445,000.00.
2. Influence your Los Angeles Water Department to sell us water at the same rate as your own parks and playgrounds. From July 1, 1960, to December 31, 1960, a period of six months, our water cost \$21,920.00 more under the commercial rate than it would have at the park and playgrounds rate.
3. When community meetings are scheduled to determine the type of plantings and plant materials to be used; attend these meetings and be a stabilizing influence in keeping the plantings within reason insofar as the cost of planting and subsequent maintenance is concerned. Exotic plants and complicated plantings must be reserved for those who are interested in detail, and not an over-all effect.
4. Understand the use of specific plant materials and help to explain this to your community. At the present time, fast growing plants are used to give immediate effect, while slower growing, more desirable plants are becoming established. Frequently, we are opposed by individuals or groups when we start to remove the fast growing plant to make room for the long lived, slower growing plant.
5. The landscaping which you now enjoy has been made possible by laws enacted by your State Legislature. If you agree or disagree with what is being done, let your individual legislators know your feelings so that he may be guided in his future actions.

I am grateful for the opportunity to share with you our maintenance problems and for your kind attention. Thank you.

Mandevilla splendens

LYLE PYEATT

This summer a strikingly colorful plant, *Mandevilla splendens*, has attracted the attention of many visitors to the U.C.L.A. Botanical Garden. A rooted cutting of this woody climber, received in July 1960 from Longwood Gardens, Kennett Square, Pennsylvania, was grown under lath and three months later several flowers were produced. In late fall 1960 the young plant was placed in an unprotected, sunny location in the Botanical Garden. The vine is now ten feet long with many axillary branches, and has been flowering continuously since early summer. The flower opens light pink with a darker pink throat and the color intensifies with age. The flower drops from the plant after about five days.

For many years it was known as *Dipladenia amoena* at Longwood Gardens. In 1956 it was identified as *Mandevilla splendens* by an authority on the family Apocynaceae. There is some evidence to suggest that this plant may be hybrid origin, but the present name will remain until more information is available. The history and a complete description appeared in *Baileya* 4:99-101 (1956).

This beautiful climber shows real promise for selected locations here in the Southland. The hardiness and adaptability of the plant will continue to be watched with great interest.

Plant Display Labels

J. T. MCGAH

A history of plant display labels would make interesting reading, and would lead us back for centuries. Nothing so comprehensive will be attempted here. However, a few notes on the new fiberglass display label used at the Los Angeles State and County Arboretum will be considered.

When plants are assembled into collections, such as in an arboretum or botanic garden, these collections present the problem of adopting a durable display label that can be produced in the greatest number, economically. Two reasons for the use of display labels are: a) to supply information for the visiting layman; and b) to enable the area gardeners to preserve the name of the plant for his own and other staff members use.

Before adopting any type of label material as the one that would best meet our general requirements, several factors had to be taken into consideration:

1. Durability
2. Visibility and legibility
3. Cost of material and labor
4. Placement and removability
5. Salvage and re-use of valuable parts
6. Susceptibility to tampering
7. Desirability of variable sizes

It must be understood that no two people agree on the type of label they like to see, the price they consider reasonable nor the information they want to present.

The extent to which display labels may be used, often is determined by the unit cost of the label. Our unit cost must be low, regardless of anything else. Since vandalism is a problem, once the label is placed in the field, strength of material and replacement are factors affecting the unit cost. Labor cost in preparing a label also influences the unit cost. To keep this cost at a minimum, the label must be easy to make and consume a minimum of time in its production. Research has and is continually carried on in an attempt to meet these demands. New materials, new methods and new testing techniques are constantly being tried.

The present fiberglass label has successfully passed the various tests and production requirement over a period of fourteen months.

The production of our display label consists of two operations. Information to appear on the label, the size of the label and the number of such labels are supplied to a commercial firm which makes the label proper. The completed label is then attached to the display stanchion at the Arboretum.

MATERIALS AND METHODS: Solid components of the label are:

1. One sheet of fiberglass reinforcement mat, 1 oz. per square foot.
2. Two sheets of fiberglass veil (mat).
3. Two sheets of 60 pound T-02 pigmented alpha cellulose paper.
4. Two sheets of 29 pound alpha cellulose overlay paper.

Labels are typed on the 29 pound alpha cellulose paper. An I.B.M. electric typewriter, specially built for 6½ point spacing and using a special ribbon, is used to print label information.

The 'sandwich' of fiberglass, veil, typed insert is then saturated with an acrylic modified polyester resin blend which includes one-half of one percent ultra-violet light absorber for maximum light stability. Molding of the sandwich is done using a pressure of 150 psi at 230 degrees F.

After lamination and after the labels are cut to the desired size, they are attached to a 20 inch long, poly-vinyl chloride stanchion. The stanchion is angled and flattened on one end to carry the label. The other end is pointed for ease of insertion into the soil.

To secure the label to the stanchion, our shop constructed a drill jig for drilling two holes in each piece (label and stanchion), using a #30 drill. Labels are then attached with Cherry Blind Rivets (aluminum) specified as CR 117-4-8. A hand operated Cherry Rivet gun G-25B is used to press the rivet into position.

The cost of a completed fiberglass display label, measuring 3x5 inches, in field position is:

Label material, typed insert, lamination cut to size,	
rivets, drilling, riveting, placement.	\$0.31
Stanchion	0.49
Total	\$0.80

Life expectancy 10-12 years.

It is not the policy of the Arboretum to recommend specific commercial firms with which we may do business, for obvious reasons. However, since label making is a form of 'family' interest among arboreta and botanic gardens, we feel that any help we may render to sister organizations justifies 'naming names' in this instance. Labels, complete except for stanchion, rivets, etc. are made by L. E. Bush, Creative Products, Inc., 14832 Arrow Highway, Baldwin Park, California. The stanchions are supplied by: Mr. E. C. Teel, Plas-Tec Industries, 1018 South Gerhart Ave., Los Angeles 22, Calif.

Arboretum Plant Recorder



A sample of a 3"x5" plastic display label. The first labels had a white background; the present labels have a light green background (the green color could not be reproduced here).

COVER PICTURE

Mandevilla splendens. Compare diameter of flower with 2-inch wire mesh. For a complete description of this beautiful flowering vine, please read the article by Mr. Lyle Pyeatt, Botany Department, UCLA, Photo by Albert Hill.

How Doth the Busy Bee

J. ALEX MUNRO

What is there about a colony of bees, viewed through glass, that attracts young and old folk alike? Probably the practical answer is that the bees can be seen, in safety, going about their normal activities.

Included among the many attractions to be seen at the Los Angeles State and County Arboretum in Arcadia, California and nearby Descanso Gardens of La Canada are observation beehives for the 1000 or more daily visitors to take a "look-see" during their visit. One of these glass-walled hives is located within the rotunda between the library and administration building entrances of the Arboretum and the other is displayed in the Garden House of Descanso Gardens. Similar exhibits have been prepared for the Childrens Education Center at both places.

Almost any day the bees may be seen storing the tiny droplets of honey, or pellets of pollen, they've collected from the flowers, or going about their many other hive duties. The scout bees may be seen conveying information regarding new honey and pollen sources to the other members of the colony. They use sign language for this, which Dr. Karl von Frisch, an Austrian scientist, appropriately called the "bienen ballet." The so-called bee dance is readily interpreted by the workers who benefit from such information when they go afield to collect from the flowers.

Youngsters with their sharp eyes are quick to recognize the different members of the colony—the queen, drones and workers. There is the frequent call to be heard, such as, "Hey Mom (or dad) come and see the queen bee," etc. A large size photograph alongside shows the three kinds of bees and helps in identifying them. It is explained that development from the egg to the adult stage is 16 days for the queen, 21 days for the worker bee and 24 days for the drone; that the main duty of the queen bee is to lay eggs,



Left to right: Relative size of the three honey bees in a colony—Drone, Queen and Worker.

and that the number of eggs she lays may vary from a few to upwards of 2000 per day depending upon the size of the colony and its ability to take care of the developing brood.

In that the bees, by nature, work best in a darkened hive or enclosure, it has been necessary to attach drop-doors or a curtain over the glass to exclude the light, except when raised for brief periods to permit observations.

Color illustrations, taken from the National Geographic Magazine, displayed in the background answer many questions from the visitors. Little does this winged ally of mankind realize what a practical nature study proposition it represents or how well it has symbolized industry since remote times.

Arboretum Entomologist

BOOK REVIEWS

Padilla, Victoria

Southern California Gardens, An Illustrated History.

University of California Press, Berkeley. 1961. 359 pp. illus. \$10.00

The modest title of this book possibly may not suggest adequately to the person who sees it in a shop or on a library shelf the excitement and romance to be found within or the broad scope of this book. It is first of all, as the subtitle denotes, an illustrated history of horticulture in southern California from the days of the Indians and the establishment of the chain of Franciscan missions by the Spanish. As such, it is as important a contribution to Californiana as would be a history of the film moguls and personalities. Perhaps the people of horticulture were less flamboyant but they too were often colorful individualists.

The story of the writing of this book is in itself a tribute to the vision of the directors of the Southern California Horticultural Institute who voted in 1954 to start to collect information and to seek an author who could be commissioned to complete the work. The late Manfred Meyberg, then president of Germain's, was particularly influential in starting the project, and the book is dedicated to his memory. The Horticultural Institute, although very small, has an impressive record of successful ventures. At first, many delays and disappointments were experienced. After the passing of this great horticultural leader, the assistance of his widow and the combined resources of the Institute and the University Press made this splendid volume possible. An additional necessary factor in this success was the fortunate availability of Miss Victoria Padilla who took a leave of absence from her teaching position to do the necessary research and writing.

The result is essentially a bargain buy in the quality book field—a book which will probably some day become a treasured collectors item. It has a rich gold-lettered binding and is lavishly illustrated in both color and black and white.

The book begins with a brief description of the topography and climate of California, which is followed by a long connected narrative of the development of horticulture in the state from the Spanish discoveries and the founding of the Franciscan missions beginning with the foundation of the Mission San Diego de Alcalá in 1769. The padres of the missions were often excellent architects and agriculturists. The missions operated the test plantings and agricultural experiment stations of their day and a great deal of their contribution has persisted down to the present time. Some of their fruit varieties are still useful—as, for instance, the mission fig, olive and grape.

The transition years of 1840 to 1880 saw the beginning of commercial fruit growing and a rapid influx of Yankee influences on the Hispanic civilization. The author conceives the great period of awakening and development to have been in the years from 1880 to 1900. This was a great period of colonization and the establishment of many important industries and institutions.

The story begins anew in a series of inspiring biographical sketches of some of those great personalities in horticulture who enriched not only our gardens, but also the lives of those who knew them. Here Childs, Sexton, Shepherd, Franceschi, the Armstrongs, Payne, Sessions, the Howards, the Bodgers, Riedel, Hertrich, Orpet, Meyberg, Evans, and others live again in the recounting of their achievements.

The book should be considered as a work of serious, careful scholarship. Appendices include climatic data for the region, plant lists and a bibliography. Two indices are provided—one general and one for plant names.

The author is an adrent horticulturist and plant collector and brings much first hand knowledge of plants to the task. The book is free of the grievous botanical errors which disgrace some books of this type. We noticed a few misprints which should be corrected in future editions.

Substantial sections are devoted to the most useful ornamental trees of southern California. Another chapter treats the history of the rose in California. The principal parks and botanic gardens of the section are described. The final chapter discusses contemporary trends in landscape design.

If you are interested in plants and gardening or in the local history of this section of our state you will want to obtain this book while it is available.

V. T. Stoutemyer

WEATHER RECORD — 1960

Los Angeles State and County Arboretum, Arcadia, California

MONTH	TEMPERATURES				MEAN	RAINFALL INCHES	EVAPOR- ATION INCHES	RELATIVE % HUMIDITY
	AVERAGE		PEAKS					
	MIN.	MAX.	MIN.	MAX.				
January	38.7	60.2	28.0	76.0	49.4	3.05	1.715	37
February	40.6	64.0	33.0	75.0	52.3	2.55	2.175	39
March	48.0	70.1	38.0	91.0	59.0	1.39	2.945	41
April	48.5	75.3	40.0	95.0	61.9	2.62	5.055	38
May	52.1	78.6	42.0	95.0	65.3	.07	5.855	41
June	52.3	83.9	41.0	98.0	68.1	.02	6.305	43
July	60.5	93.4	52.0	108.0	76.9	—	8.045	33
August	58.7	89.3	54.0	98.0	74.0	—	7.505	39
September	60.0	90.3	54.0	107.0	75.1	.06	6.715	31
October	52.7	81.1	44.0	96.0	66.9	.12	4.450	37
November	43.7	67.2	36.0	82.0	55.4	3.64	2.000	42
December	39.9	70.6	32.0	85.0	55.2	.15	2.770	29
Total inches						13.67	55.535	

GENERAL OBSERVATIONS

The lowest temperature, 28 deg. F. was recorded on January 2 & 3. The highest temperature, 108 deg. F. was recorded on July 20th. During the year there were fifty-one mornings of 40 deg. F. or less. Seven of these mornings the instruments registered 32 deg. or less. A temperature of 90 deg. F. or more was recorded on seventy-eight days; twelve of these days were 100 deg. or more.

The lowest average relative humidity percentages occurred in September ;the highest were in June.

Rainfall was measured on thirty-three days for a total of 13.67 for the year. The greatest storm total was 2.60 inches on April 27-28th. The greatest monthly total was in November when 3.64 inches fell.

A total of 55.535 inches of water loss through evaporation was measured during the year. This was 1.495 inches more than in the previous year of 1959.

J. T. McGAH, Plant Recorder and Weather Observer

WEATHER RECORD — 1960

University of California, Los Angeles, Subtropical Horticulture Area

TEMPERATURE					PRECIPITA TION
MONTH	AVERAGE		PEAKS		TOTAL MONTH
	MIN.	MAX.	MIN.	MAX.	
January	40.6	61.7	33 .	80	4.41
February	43.1	63.5	33	74	3.03
March	47.4	68.8	40	89	0.36
April	50.0	72.0	41	89	2.64
May	51.9	73.5	44	84	0.00
June	55.9	75.1	50	88	0.00
July	59.6	81.7	53	96	0.00
August	59.0	78.7	55	88	0.00
September	58.5	83.3	53	96	0.00
October	51.0	74.3	43	92	0.00
November	44.2	66.4	37	75	3.37
December	42.6	68.7	33	82	0.26
Prepared by Lyle Pyeatt					Total inches 13.81



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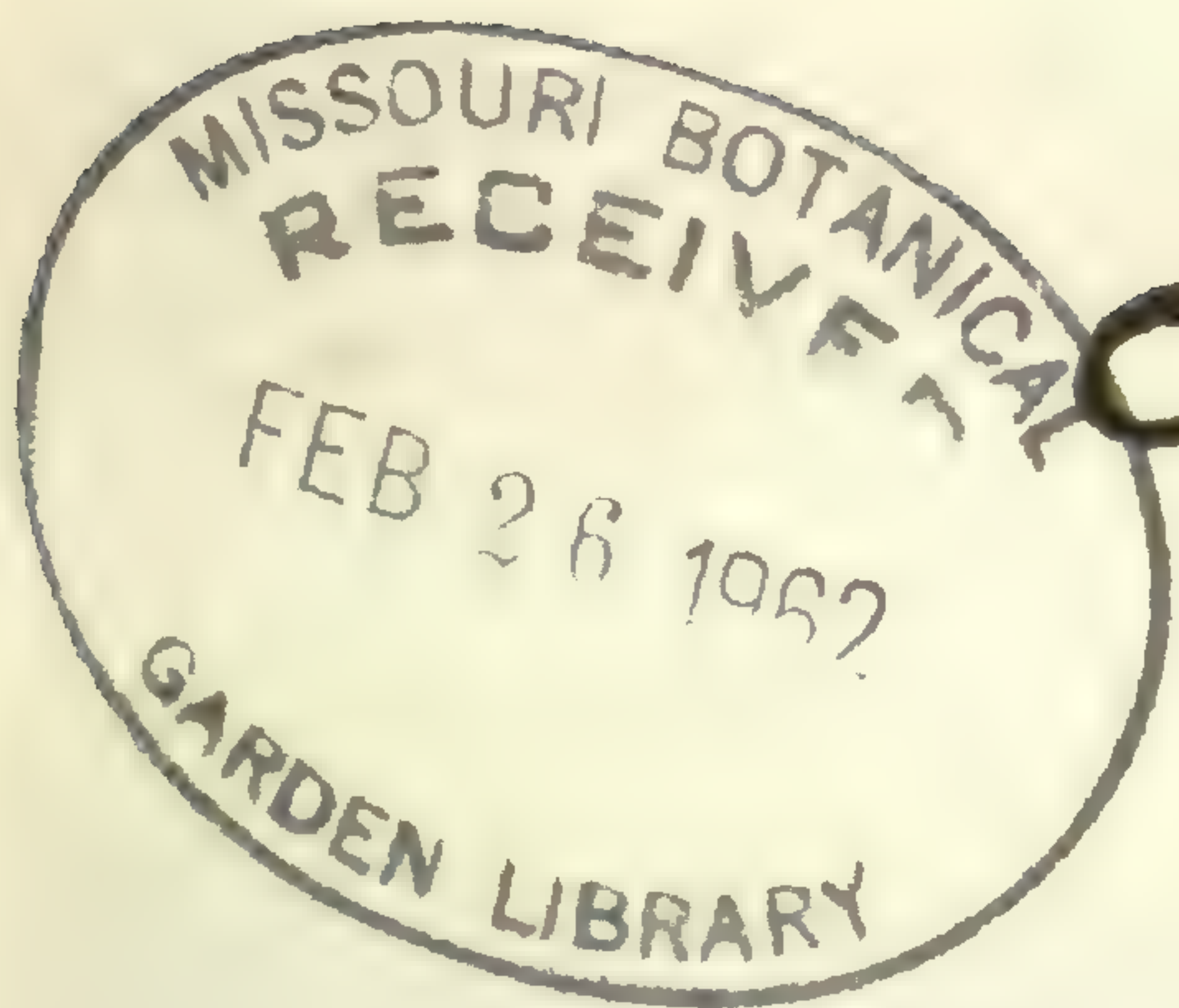
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Fremontia California Glory

PERCY C. EVERETT

One of the outstanding floral features at Rancho Santa Ana Botanic Garden during April and May is the magnificent display afforded by a group of *Fremontia* plants growing along the road on the east side of the mesa. The glory of this sight evokes enthusiastic comment from many visitors, and we have often been urged to introduce this plant to the public. We have concluded after several years of study that selected clonal material should be made available. Hence, we are bringing to the attention of horticulturists and the general public one of the selected plants, which we have named *Fremontia* 'California Glory.' We feel that this plant is truly representative of its name.

Fremontia 'California Glory' is a presumed hybrid between *F. californica* and *F. mexicana*. It is a tall, rather stiff, almost tree-like shrub to 20 feet high and nearly as wide with several thick central leaders clothed with long, somewhat arching branches which are in early growth covered with a dense brownish tomentum; this later drops off, leaving a grayish brown bark. The leaves and flowers are densely borne, mostly on short, lateral, spur-like branchlets. The leaves are 5-veined at the base, roundish-ovate, more or less 3-lobed, somewhat shiny on the surface when young but later turning to a dullish green, and sparsely stellate-pubescent above, densely stellate beneath, the latter turning to a tawny color, 1¾"-2½" long and as wide, but new leaves are larger and with more deeply cut lobes. As with the species, there are no petals. The calyx is lemon yellow (Royal Horticultural Society Color Chart = Lemon Yellow 4; Nickerson Color Fan = Vivid Yellow 5Y 8/12), becoming slightly reddish on outside with age, 2¾"-3½" across (occasionally 4"), basal pits puberulent with a few scattered hairs; seeds are black, somewhat carunculate, and mostly larger than the species.

Some of the main differences that point to hybridity are weak seedlings from the cross, wide variation among the resulting seedlings and flowers, vigorous growth habit, seeds, size of flowers, and profuse blooming. The flowers are generally larger than either parent, being on the average 3" in diameter, although the difference is not so great with *F. mexicana*. The flowers are deeper colored than *F. californica* but not so deep as *F. mexicana*, and whereas the flowers of the former species are flat and of the latter are open-campanulate, in *F. 'California Glory'* they are shallowly-cupped. The leaves are 5-veined; with *F. californica* they are 1-3- and *F. mexicana* 5-7-veined. On the whole, the leaves resemble those of *F. californica*. The pits at the base of the calyx-lobes are puberulent and have a few scattered hairs. *F. mexicana* lacks the hairs but has puberulency, and *F. californica* has hairs in the pits but is not puberulent. The great masses of flowers on the short lateral branches and terminal stems, blooming all along the branches at more or less the same time are quite indicative of the habit of *F. californica*. We counted 115 3-in. flowers on a 6-foot branch. The flower production is so abundant that the plants appear to be almost leafless when *F. 'California Glory'* is in full bloom. Flowering occurs during April and May which is quite typical of *F. californica*; *F. mexicana* flowers earlier and sporadically through the year, a habit also noted in the cultivar. The seeds of *F. 'California Glory'* are mostly larger than the species, black and slightly carunculate. The seed of *F. californica* has a large caruncule, is either dull black or brownish, while that of *F. mexicana* is shiny black, and slightly carunculate or not at all. The growth habit and general appearance of the plant are definitely typical *F. mexicana*, particularly the long, somewhat arching branches and tall finger-like central leaders.

Part of the requirements for the naming of cultivars is to recite the history of the plant as well as to indicate the more technical characteristics and differences of the plant involved. The background of *Fremontia* 'California Glory' was for some time rather confusing; however, we now feel reasonably sure of its parentage. At the junction of a hillside road at the former site of the Botanic Garden at Rancho Santa Ana, in Orange County, there grew side by side three *Fremontia* plants. Two of these were *F. mexicana*, and for the third there was some question as to its true identity. However, later investigation proved it to be a plant raised from seed of a *F. californica* collection from the wild. Because this plant seemed different than other *F. californica* plants growing close by, and because of its larger flowers, later flowering, and other less prominent characteristics, the writer always had an interest in the plant. When it came time for the Garden to be moved to the Claremont site, it was requested that seed be collected from this plant, and progeny were later raised under Propagation Number 6411.

On September 25, 1952, $\frac{1}{8}$ oz. of seed was soaked for 24 hours in water which first had been heated to boiling. The seed was then sown in a flat with $\frac{1}{4}$ peat moss and perlite (Sponge Rok), $\frac{3}{4}$ loam, covered with chopped "Nodampoff" sphagnum moss. First germination occurred one month later and maximum germination with $2\frac{1}{2}$ months. Approximately 75 seedlings came up and 65 were potted. Some losses occurred in the nursery, and on Sept. 28, 1953, 39 were planted in three locations. Two of the groups appear not to have fared too well, nearly all being dead within five years. This was due to heavier irrigation and poorer soil conditions. However, the largest group, planted



Close-up of a small portion of a typical flowering branch. Photo by author.

along the east mesa road, did exceedingly well, suffering only one plant loss. There are now 21 plants alive, up to 18 feet high and with equal spread where permitted to freely develop. Eighteen of these plants make one long clump of nearly 100 feet, and are a spectacular sight when in full flower.

Some four years ago when these plants had assumed sufficient size, and as they continued to prosper in the location, we began to study them more carefully, particularly their heritage, and to find the best method of asexually produce additional material. One of the remarkable facts about the plants is that although they showed every indication of hybridity, they appeared to be quite uniform in general appearance. One of the most notable differences among the group was the time of flowering. The earliest plants started blooming in mid-March, while the latest began in mid-April to May. Further study revealed other more technical differences not so discernible to the eye. It was most difficult to make a selection; however, we have settled on one plant that seemed superior and have so labelled it and have fully complied with all requirements for the proper naming of cultivars. Pressed specimens were made under collection number 24,318 and deposited in the Rancho Santa Ana Botanic Garden herbarium. Duplicate specimens will be distributed to other institutions.

Two collections of seed from the group have been sown and of the resulting seedlings, 80 were planted, and not more than a half dozen were alive after two years. There was a wide variation both in growth and flowers among the plants; they were weak, and died rapidly. Cutting-grown plants from our selected cultivar have shown remarkable vigor and no losses have resulted since they were planted two years ago. Of a total of nearly 300 cuttings, slightly better than 30% were rooted. However, this included sundry experimental methods, as *Fremontia* cuttings have not been successfully rooted, at least to our knowledge. Tip cuttings taken in late May to July, with a slightly hardened base and treated with one of the root promoting compounds (we used Rootone), inserted in a mixture of 75% perlite, 25% peat moss, and kept under intermitten mist with or without bottom heat proved to be the most successful. Using this method, better than 60% were rooted in some lots. We still need to improve upon our procedures to obtain a higher percentage of rooting.

Growing *Fremontia* successfully among general garden plantings has always been rather difficult. Usually, overwatering and poorly drained soils contribute to their early demise. We cannot categorically say that *Fremontia* 'California Glory' will be any different. However, experience to date indicates that greater success should be the result. *Fremontia californica* is not nearly subject to the diseases that so readily kill *F. mexicana*. To be on the safe side, we do recommend the best drained soil possible, and relatively small quantities of water. Our plants get occasional irrigations and so far no harmful effects have been noted. Also, we urge that plenty of room be allowed for the plant to develop properly. It needs plenty of space!

Fremontia 'California Glory' has been distributed to the following growers and institutions, all in California: Deigaard Nurseries, Monrovia; Saratoga Horticultural Foundation, Saratoga; Monrovia Nursery Co., Azusa; Kramer Bros. Nurseries, Upland; Theodore Payne Nursery, Los Angeles; Santa Barbara Botanic Garden, Santa Barbara; Greg's Nursery, Gardena; L. L. Edmunds Native Plant Nursery, Danville.

The Cover Picture

ELIZABETH BEEBE

Reprinted, by permission of Billie and Vern McCaskill, from *The Camellia Review*, Vol. 16, No. 3, December 1954.

Confounding the old adage that 'Never the twain shall meet', East has met West in lovely success in the *Camellia hiemalis* 'Bill Wylam'.

With the Japanese mother, 'Shishi-Gashira' and the very western namesake, William Wylam, Vern and Billie McCaskill have produced an extraordinarily distinctive hiemalis.

Mutual friends for many years and especially mutual admirer of the species *hiemalis*, it was only a natural result that when the McCaskills fostered this particularly distinctive seedling which Bill admired greatly, they should give it the name of their good friend.

The parent plant is about six years old and with two- and three-year-old grafts, the habits of the 'Bill Wylam' are well established. The bushes are large and upright. The foliage rich, with leaves darker than usually found among hiemalis. The blooms are prolific, large for hiemalis being around three inches across, semi-double with petals beautifully fluted and edges scalloped. The color ranges from deep rose to a deeper clear rosy red when the bloom is fully opened, and the blooming period lasts over a three-month period; in southern California from October through December, although that might vary with locality.

Best of all, with its beauty the 'Bill Wylam' is so tractable that it can be used for most any type of landscaping.

Bill, himself, is of course very proud that this particularly dramatic hiemalis was named after him. Seeing it first at its best, Bill said, "The flowers look like shimmering sequins against dark green satin."

The Editor wishes to thank Mr. and Mrs. Vern McCaskill for the generous loan of their printing plates, making possible to have a three color print for the cover of this issue of *Lasca Leaves*.

Educational Opportunities for Botanical Gardens and Arboretums

DONALD P. WATSON

Reprinted from *American Association of Botanic Gardens and Arboretums, Quarterly News Letter*, Issue No. 49, October, 1961. Dr. Watson was a guest speaker on this same topic at the Los Angeles State and County Arboretum, Wednesday, December 27, 1961.

Americans in the future will look to botanical gardens and arboretums to find well trained plantsmen. In the past many of our most adept gardeners have been trained in other countries, in countries where plant appreciation is taken for granted, where many technical schools are emphasizing horticultural skills.

The lack of appreciation of plants in the United States is appalling. The home owner is poised waiting for help. Few schools, colleges, and universities are catering directly to this demand. Consequently, a great opportunity has arisen for botanical gardens and arboretums to train more plantsmen . . .

Until the home owner has more opportunity to become better informed, until he learns to discriminate between the really fine quality evergreen and a spindly cutting, the salesman will continue to depend upon that customer's ignorance. Look at how this lack of appreciation has led to an increase in the sale of artificial flowers. In the last year, 24% of the wholesale value of flowers was the sale of artificial materials. And why won't this lead to more artificial copies of outdoor trees and shrubs? They need no water, no fertilizer, no spraying, no sunlight, all of which appeal to the ill-informed home owner. The consumer, the retailer, and the grower need the same kind of information if we are to have a well informed consumer. There really must be no secrets.

EXISTING HORTICULTURAL EDUCATION

It is difficult to find a place to educate a plantsman. Our younger generation is growing up, going through grade school, high school, and often college, not knowing that there is an opportunity, let alone a profession, as a trained plantsmen. For many it need not be a profession but there is a great need for knowing more about the culture of plants around us, perhaps merely to improve our way of life, just as there is for art or music or any other cultural subject.

A recent survey made by the American Association of Nurserymen in cooperation with the American Horticultural Society has shown that schools like the California Polytechnic Institute at Pomona and San Luis Obispo and the Long Island Agricultural Technical Institute in New York train the largest number of students in vocational Ornamental Horticulture, but there are only 3 out of our 50 land-grant colleges that train any large number of students in a vocational manner. Actually, where do the directors of botanical gardens and arboretums look for trained plantsmen? Just where do you people find them? Is it not true that often the most suitable prospects have been trained abroad?

The four-year program for training horticulturists at these state colleges is not usually designed primarily for training plantsmen. Instead, the effort is to develop a well rounded individual with emphasis on plant science and opportunity for specialization in business, plant growth, fundamental or applied science. The force of present international conditions has caused the training in all sciences to be jacked up and up and up, so that most universities are turning out more and more research workers, teachers and professors. Certainly many university graduates are scientists, not plantsmen. Since this is necessary, I don't mean to quarrel for one minute with the work of the universities other than that sometimes advanced degrees are gained at the expense of practical experience. Frequently, the best graduates of universities are those who have had some early fundamental training with nurseries, parks, gardens or landscape contractors.

The lack of trained plantsmen combined with the doubling of leisure time in the last 50 years, the building of millions of new homes, supplying larger and larger numbers of uninformed suburbanites, portrays a brilliant future for training plantsmen. The home owner is starved for just the kind of information that botanical gardens and arboretums are prepared to supply.

SUGGESTIONS FOR EDUCATIONAL PROGRAMS

It seems logical that this training will be provided by botanical gardens and arboretums, because it is the history of their performance to have arranged an adaptation to suit the need . . .

More large estates are becoming available, some with specifications that they are to be of service to the public. Administrators of these gardens cannot stand aloof and hold court with their dead specimens in museums. Nor can they sit and wait for the people to arrive. They are dealing with life. They must take the clutter from their stock room and produce a show window like a fine jeweler with an ever changing display of a

choice few flowering rubies, emeralds and diamonds. The public garden must serve more than the few people who will search on their hands and knees to find the labels and it must respond to the demands of the large number who want answers and don't know where to find them.

Plant people have always been modest, but today they are going to have to stand up and holler if they are going to be heard. They are going to have to make artistic and adaptive demonstrations. We cannot just sit and be idealists in a world that is dominated by business. We are going to have to adapt our programs to suit the public the way that it has been done at the Desert Botanical Gardens in Phoenix, Los Angeles State and County Arboretum, Brooklyn Botanic Gardens and elsewhere.

Of all the opportunities, mass communication is probably the most important, and of the various forms of communication, television has more to offer than is realized . . . It is easier to demonstrate how to prune a tree in front of the television camera, than to try to do it with a descriptive leaflet.

We shall see the day when many botanical gardens and arboretums have outdoor garden television studios with patios that are built for cameras, where they will be lawn demonstrations on sodding compared to seeding, where the color camera will bring into focus and share some of the greatest beauty in the world. And this cannot be done by professional actors. It is going to have to be done by people who know plants, people who are plantsmen, trained to perform before the camera . . . The success of every botanic garden will depend on its originality and its adaptation to local demands. Other means of communication must not be neglected or discontinued but television has not been used as widely as it might.

Now you are going to say, well this is all right for Watson to say. He has elaborate ideas, but does he think there are unlimited finances and most of us don't already have enough to do. Most of us are not primarily educators and we have had such terrific increases in our costs of operation.

But I shall answer that many of you are operating tax supported institutions, institutions that have an obligation to serve the public. I will answer that through this service some of the programs can become self-supporting. I know of a fine work at Indiana University where Dr. Shaluka trains teachers to teach gardening to children from the city schools. After having done this for some time, she is now receiving financial support from the city. Television can be made to show a profit. It does not necessarily need to detract from any horticultural program to have it profitable. On the contrary, when it becomes too inexpensive or more often free it is rarely completely appreciated. One of the greatest criticisms of plantsmen today is their willingness to do too much for nothing. This, in itself, makes them less appreciated . . .

In conclusion, let me emphasize that in the future on top of maintaining plant collections, plant introductions, gardens, parks, plant breeding, botanical research and many other responsibilities, we are going to have to think about accepting an opportunity to also serve our plant-starved millions with inspirational demonstrations, with streamlined techniques of education.

*Professor of Horticulture
Michigan State University*

Species of *Microlepia* Cultivated in California

BARBARA JOE

Some of the most beautiful and useful ornamental ferns in southern California are those belonging to the genus *Microlepia*. Members of this group, mainly a variety of *Microlepia strigosa*, cover most of the slopes in Fern Dell, Griffith Park and form the background foliage for many other areas of the Los Angeles City Park system. Although these ferns are familiar to many California gardeners, their scientific names are not well known. In Greek *Microlepia* means small scale and refers to the cover protecting the fruiting body.

Microlepia strigosa are vigorous ferns and adapted to a range of sun or shade, dryish or damp soil, clay or sandy soil. In the proper setting, the mass of lacy foliage imparts a cool fern woodland atmosphere to the scene. These ferns are especially suited for background, slope, border, or foundation planting. The compact clumps of rhizome are not apt to grow out of control as is true with the rhizomes of the wide creeping bracken. Singly, these ferns produce handsome accent plants with their clusters of large gracefully arching fronds. A fern in a gallon container may easily triple its size in one growing season. Ample water and fertilization produce a deeper green color and a firmer texture than ferns not so treated.

Most species of micropelias are limited to subtropical or warmer climates. *M. strigosa* has been reported to have survived temperatures as low as 18°F., the fronds were killed back and new growth appeared in spring. Experimental plots further north would be helpful in establishing the temperature limits of our other cultivated species.

In the eastern parts of United States small plants of *M. platyphylla* are offered in the trade as greenhouse subjects. Outdoors in southern California, they may easily reach a height of 6 ft. or more. The broad pinnules are a light blue-green or pale green color if planted in a sunnier site. In local gardens *M. platyphylla* is not as popular as the other micropelias because of its large size, coarser aspect and tendency to enter a longer winter rest period.

Commercially micropelias are propagated by spores, but they are also easily propagated by divisions. Divisions taken just before spring growth may produce a sizeable number of fronds by June. As in all fern divisions, each piece should have a "lead" or portion where new fronds are being formed.

The genus *Microlepia* may be distinguished from other genera by the following characteristics. The rhizome is creeping, and covered with fine hairs. The fronds are medium to large, one to three times pinnate or more. The ultimate pinnules are obliquely incised, and usually hairy or glabrous when old. The veins are free, simple or pinnately forked. The sori are slightly below the margin, terminal on the veins, and covered with a shallow hood-shaped indusium which is slightly broader than long. The indusium is attached by its rounded sides and base, the unattached side being directed toward, but not reaching the edge of the frond.

Of the thirty species only four are known to be cultivated in California, and these thrive outdoors in the southern part of the state. They may be identified by the following key.

- A. Fronds pinnate.....*M. marginata*
- AA. Fronds bipinnate or more divided
 - B. Fronds to 4 ft. or more long, 12 in. or more wide, the pinnae not fan-shaped segments



Microlepis indusium



Microlepis strigosa var. General habit of plants growing in Fern Dell, Griffiths Park, Los Angeles

- C. Fronds large, to 10 ft. or more long, the segments broad, coarsely toothed. *M. platyphylla*
- CC. Fronds medium, to 4 ft. long, the segments much incised, finely toothed.
 - D. Upper surface of rachis densely hairy, the lower pinnae usually 3 in. wide or more, broadly tapering. *M. firma*
 - DD. Upper surface of rachis essentially smooth, the lower pinnae usually 2 in. wide or less, narrow tapering
 - E. Fronds to about 1 ft. wide, usually widest at the middle, the pinnae usually not drooping at the ends, the lower pinnae gradually tapered. *M. strigosa*
 - EE. Fronds to about 2 ft. wide, usually widest at the base, the pinnae usually drooping at the ends, frequently with the lower pinnae having the basal pinnule pair much longer than adjacent pinnules. *M. strigosa* var.
- BB. Fronds not more than 1½ ft. long, mostly 2 in. or less broad, the pinnae condensed to fan-shaped segments. *M. strigosa* forma *MacFaddeniae*

Microlepia firma Mett. ex Kuhn (misapplied to *M. pilosula*). Fronds dull green, to 3 ft. long, triangular, mostly tripinnate, to tripinnate-pinnatifid at the base, the lower pinnae broad, 3 in. wide or more, the rachises and midribs densely hairy above, with hairs extending to the leaf surfaces. India. Semi-hardy, 2-3 ft. tall. Shade. Evergreen. General aspect more delicate than *M. strigosa*, the fronds more arching, dull green.

Microlepia marginata C. Chr. Fronds 1½ to 2 ft. long, to about 1 ft. broad, one pinnate; pinnae linear, cut down about halfway or less to the rachis into bluntish oblong lobes, the base above parallel with the stem, that of the lower side obliquely truncate, the rachises and under surfaces densely hairy. Ceylon, Himalayas, Japan, China. A recent introduction from Japan. Easily grown by spores. Young plants like Boston ferns in general aspect.

Microlepia platyphylla (D. Don) J. Smith (*Davallia platyphylla*). Large coarse fern, the fronds to 10 ft. long or more, pinnate-pinnatifid to bipinnate, the ultimate segments broad, tapering and coarsely toothed, bluish-green to yellow-green. Nepal, India. Semi-hardy. Semi-evergreen. To 15 ft. Shade.

Microlepia strigosa (Thunberg) Presl (misapplied to *M. speluncae*). Fronds erectish, to 3 ft. long, to 1 ft. wide, bipinnate to tripinnate at the base, the rachises and midribs essentially without hairs, the segments light green. Tropics. Semi-hardy. Evergreen. To 3 ft. Shade or sun tolerant. Erroneously passing as *M. speluncae* which is tripinnate to quadripinnate and not known in cultivation.

A cultivar with a crested apex is cultivated as well as the following:

M. strigosa, unnamed variant. Rhizome clumps less compact than the species, the fronds more arching, broader, to 2 ft. wide, usually widest at the base, the pinnae usually drooping at the ends, the lower pinnae usually having the basal pinnule pair much longer than the other pinnules. Evergreen. To 3 ft. tall. Shade or sun tolerant. More desirable than the species in being a fuller more graceful plant and entering active growth much earlier. Formerly identified as *M. substrigosa* which differs in



UPPER PICTURE: Left to right; Lower pinna of *Microlepia strigosa*, frond of *M. strigosa* forma *MacFaddeniae*, lower pinna of *M. strigosa*. LOWER PICTURE: Left to right: Young frond of *M. marginata*, lower pinna of *M. firma*, lower pinna of *M. platyphylla*.

having the indusia set back from the margin about 2 to 3 times the length of the indusium, the vein ends are also far from the margin.

M. strigosa forma *MacFaddeniae* Morton (sometimes misapplied to *Nephrolepis Duffi*, *Lindsaea cultrata*). A small fern with very narrow fronds, the pinnae so condensed as to have imbricated fan-shaped segments, the lower pinnae often less condensed and much longer than those above. Origin unknown. Semi-hardy. To 1 ft. tall. Evergreen. Shade.

Cultivated ferns superficially similar to microlepias include the dennstaedtiads, and possibly some of the athyriums or Lady ferns. Of these, microlepias are the commonest in southern California cultivation. Dennstaedtiads are sparingly cultivated and can be distinguished by the cup-like indusium borne at the very edge of the frond, while athyriums have chaffy or broad scales along their stipes and never any hairs.

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The Aesthetic and Recreational Values in Botanic Gardens

ELIZABETH ANN MOREL

A Thesis submitted in partial satisfaction of the requirements for the degree of Master of Landscape Architecture, College of Environmental Design, in the Graduate Division of the University of California. This is a young landscape architect's views on the values of botanic gardens (and could well have included arboreta) to modern day living. We felt that this thesis has much to offer the lay plantsman in history, development and uses of botanical institutions starting, as Miss Morel has, with the Royal Garden of Thotmes III in 1500 B.C. She has compiled her data from some 120 authors, bringing together, in a single paper, a rich source of information on a subject of interest to all of us. Because of the length of the paper, we shall print it in Lasca Leaves as a continuing feature for several issues. Ed.

CHAPTER I

PATTERN FOR A STUDY OF BOTANIC GARDENS

An investigation of botanic gardens and arboreta offers many areas for study, emphasis, and consideration. An adequate treatment of the comprehensive topic would require many volumes, and a much more extensive work than is undertaken here. In this necessarily brief study, attention is to be given to certain limited evolutions of purpose as these are identified and implemented in outstanding botanic gardens, over a period of many centuries, and across the continents of the earth.

PURPOSE OF THE INVESTIGATION

The purpose of this investigation is to identify and define the values available to mankind of botanic gardens, with emphasis being given to design evolution and to aesthetic considerations. In order to accomplish this purpose, an intensive study has been made of research material attesting to the occurrence and development of botanic gardens from as early as 1500 B.C., according to currently available records. The information encountered hereby, it is hoped, will have significance leading to a better understanding of today's botanic gardens as well as a more general realization of potential and challenge in the planning of botanic gardens for the future.

DEFINITIONS

For purposes of this investigation it is essential, although sometimes difficult, to draw a clear line between a garden, a park, and an arboretum or botanic garden. A garden is

created for personal enjoyment and recreation, and in most instances is private. A *park* is established primarily for public recreational use and enjoyment. An *arboretum* or *botanic garden* differs from both in its conscious effort to maintain an atmosphere conducive to study, scientific research and advancement, as well as enjoyment, relaxation, and aesthetic pursuits. For this reason, certain necessary restrictions are commonly observed, which are related to the achievement of these purposes. Therefore picnicking is not allowed on the grounds of botanic gardens proper, although facilities are often located nearby; dogs, bicycles, and automobiles are excluded from the gardens. A level of sophistication in behavior is expected which will thereby further the objectives and goals, and which will be suitable for an institution of as great cultural value as any museum or art gallery. Indeed, the botanic garden is a museum of living material.

Botanic gardens (or *botanical gardens*—the terms are interchangeable) is a term now used to describe any of the great plant collections found in many parts of the world. When such gardens are concerned primarily with the collections of trees, they are called *arboretums* (or *arboreta*).

Potential and aesthetic values to be gained by the public assume paramount importance in many of the present day botanic gardens investigated. The collections are in all cases labeled, or recorded for study; they usually include among their functions opportunities for research into culture, use, and improvement of the plants.

Arboreta and botanic gardens are located over a wide range of climatic conditions. There are some gardens where only ninety days of growing weather can be expected between frosts. In some of these, extensive greenhouses are used to grow and display the collections. Rainfall ranges from less than ten inches a year to more than sixty inches, with minimum temperatures ranging from 30 degrees Fahrenheit to -40 degrees, and with maximum temperatures as high as 115 degrees. From these indications it is evident that botanic gardens are able to meet and contend with a wide range of conditions, and grow and display an even wider range of plant materials. The plants grown include ornamentals, potential economic or other research materials, and classic study plants as well as curiosities. In most cases, both native and exotic plants are grown for exhibit.

LIMITATIONS AND EMPHASIS

All the goals and purposes significant in the evolution and development of botanic gardens must be considered (and will be considered in this study) for full understanding of the history and importance to mankind of botanic gardens. However, in this paper, major emphasis is to be given to the aesthetic and passive recreational aspects. This is not to depreciate one phase or another, or to claim greater or less importance for certain specific aspects. It is, however, deliberately to select the aesthetic and passive recreational aspects for a focus in this study of botanic gardens and arboreta.

ORGANIZATION OF THE STUDY

The chapters to follow will deal, respectively, with these facets of the botanic garden: the history, values in present day gardens, evolution of design and design considerations, proposals for future development.

The history of the development of botanic gardens is to be traced from 1500 B.C. to the present. Histories and development of specific gardens are included to offer the reader a more complete background and understanding of the problems involved in developing a botanic garden. Who the persons were in connection with the early gardens, their ideals and purposes and dreams—such information aids understanding; so does information regarding site selection and acquisition, as well as that having to do with securing botanical collections in addition to financial support. Clear and similar patterns in the reasons for development are repeatedly seen as the separate histories are told.

Values found in many of the present day botanic gardens are greatly varied; they are to be shown as including scientific research, plant introduction and varietal improve-

ments leading to economic advancements, educational uses, recreation and pleasures, and aesthetic experiences for the public. Specific examples are to be cited for each of these values. A definite affirmative answer appears obvious to the question, "Is there evidence of sufficient use and appreciation of such gardens to justify their continuing development for public use?"

The evolution of design seems to have followed a definite pattern of style and its relationship to objectives throughout the history of botanic gardens, just as have the reasons for their development. Variances of style appear to correspond directly to the changing religious, social, and philosophical views of the people at given periods in time, as well as to the climatic factors of the lands in which they live. A number of specific aspects of design may be seen in this facet of the study. Some of these are to be set forth to indicate those modifications which have evolved or can be made, to assure greater experience or accrual of value from the botanic garden.

The chapter which deals with proposals for future development points out that the increasing emphasis being placed on the need for favorable public relations demands a creative and aesthetic approach to botanic garden design. Conceivably, this factor will strongly affect future development of the botanic garden as an institution. Proposing that that botanic garden serve the interests and needs of all individuals concerned and not just the plant scientist, the professional botanist, or the student, the dominant concept is set forth that gardens should be and can be arranged with regard to relationships of form, texture, color, and composition of spatial experience. This concept directly opposes that of arrangements based solely upon botanical classification, with little or no consideration given to ecological relationships or to design, but rather for a single purpose—convenience of taxonomic study. Finally, in this chapter are to be found the statements of principles derived from works of outstanding landscape architects, from studies of successful gardens (observed historically, vicariously, or by actual visitation), and from individual observation of design principles. This chapter is offered as partial answer to the question, "How can botanic gardens be planned and grown to provide deeper aesthetic impact to the visitor as well as the educational and scientific service which is primary to their purpose?"

From the foregoing, the purpose of the writer is obvious: to consider the history and design evolution of a number of botanic gardens. Hopefully, principles identified through such a study may be applied to any botanic garden or park development where the resultant effects are desired.

CHAPTER II

RESUME OF THE HISTORY OF BOTANIC GARDENS

EARLY GARDENS

The history of early botanic gardens so parallels the history of early cultivated plants that the two are often considered together and are said to be almost as old as the culture of man himself. The collection and study of plants for educational and experimental purposes have been conducted in association with the oldest of the scientific research institutions; such activities were carried on as early as the earliest astronomical observatories. Botanic gardens often were instrumental in the introduction, propagation, and distribution of economic and ornamental plants; for centuries they served as the centers of botanical and biological research. The records make clear that they played a leading role in the cultural history of mankind, and that they contributed significantly to the history and development of biology, pharmacology, and medicine.

Botanic gardens as institutions in an early form actually existed in ancient Mesopotamia, ancient Egypt, and pre-Columbian America, in the sense that gardens were then maintained for more reasons than just the production of food. One of the earliest of these for which there seems to be an authentic record is the Royal Garden of Thotmes III, believed to have been designed by Nekht, head gardener of the Temple of Karnak Gar-

dens. This was at Thebes, about 1500 B.C. However, the plantings consisted of little more than groves of olive trees, laid out along formal lines, with an impressionistic touch.

Mention is found of a botanic garden established in Athens about 350 B.C., by the philosopher Aristotle. Here he taught his pupils. The first director of this garden was Theophrastus, also a disciple, who fell heir to the garden when Aristotle died. Later to become known as "the father of botany," Theophrastus was able to improve the garden with funds supplied by philanthropic citizens.

The Chinese are credited with being the first to have instituted the practice of sending envoys to distant parts of the world to collect and bring back plants for cultivation for their economic or medicinal value. According to Crider, this occurred in the reign of Chuang-tze, about 250 B.C.

Many of the early gardens were cultivated primarily for economic rather than ornamental purposes. However, as might well be expected, the Greeks developed ornamental flower gardens, and like many other conceptions of Greek origin, these were borrowed by the Romans. Some of the best known of the Roman ornamental gardens during this later period were those of Lucullus, Pliny the Younger, and (in some part for medicinal plants) the garden of Antonius Castor.

Following the decline of the Roman Empire, botanic garden development went into semi-eclipse for a thousand years. The only notable records of gardens during this time were, first, of one established in the ninth century by Benedictine monks in Italy (for the cultivation and preservation of medicinal plants), and a physic garden founded in Tokyo some three centuries later. The mediaeval monastery gardens are said to have been precursors of the later *hortus academicus*, which was not developed until the seventeenth century.

By the middle of the fifteenth century, in pre-Columbian America, the gardens of Netzahualcoyotl, king of Texcoco, were well established. As in the European gardens of this period, medicinal plants were on conspicuous element. It is interesting to note that, according to the Mexican naturalist, Dr. Manuel Maldonado Koerdell, the Mexican people were far more advanced in their understanding of the curative properties of plants than were their European contemporaries. These large gardens were carefully cultivated, and they included flowers and other ornamentals "of rare diversity and fragrance" as well as medicinal herbs.

The differences between these older gardens and those of today are extensive, however. The modern botanic garden may be considered as more immediately derived from the private gardens of the herbalists in the sixteenth and seventeenth centuries. First of this category was the Padua Garden established in 1545, said to have looked as if made for an estate designed by Le Corbusier. It was planned in a radial-concentric design, after the city plan of the period.

Between the sixteenth and the eighteenth centuries botanic garden development spread very rapidly in European countries. Konrad von Gesner has stated that "By the end of the eighteenth century there were 1600 botanic gardens in Europe alone." But most of these were small, their operations were distinctly limited, and their mortality was high. Reportedly, many of them looked much like simplified Renaissance gardens, with four groups of beds forming a simple parterre, with a pergola on one side and in the center a simple fountain, statue, or arbor.

In the middle of the sixteenth century botanical gardens were first established for purely scientific purposes. Modern botany began because of the importance of vegetable drugs in medicine and the revival of first-hand study of the plants producing them. The Rea'le Orto Botanico della R. Universita di Pisa, in Pisa, Italy (1544), came to be known as the very foundation for modern systematic botany. The Padua Garden (1545), rivalling the garden at Pisa in age, was claimed as the first botanic garden developed for didactic purposes.

During the seventeenth century, it was found desirable to establish collections of plants thought to be of use in medical treatment. Though some were of superstition value only, many were actually used. Through this time, only the collections of medicinal plants (the *horti medici*) were considered to be scientific gardens, where the professor or director was of necessity learned in medicine, anatomy, or pharmacy as well as botany, and was also trained as a physician. Most of the plants in such collections were as listed in the *Pharmacopoeia*, though sometimes interesting plants from abroad were included. In this connection it must be kept in mind that however great may have been the aesthetic and intellectual satisfaction given by such plants, botany was then auxiliary to medicine, and the primary purpose of the collections was to provide living specimens of medicinal plants for the instruction of medical students. Most plants were believed to have potential use. The old term *simple* (Latin, *simplum*), meaning a "medicinal herb," is significant, for it implied that a plant not of virtue by itself might nevertheless be useful as an ingredient of "cure." Among the gardens notably connected with this purpose were the Leyden Botanic Garden, Netherlands (1587), the Jardin Botanique in Paris (1635), the Edinburgh Botanic Garden (1660), and the Chelsea Physic Garden in London (1673).

By the end of the seventeenth century, the botanic garden at Leyden (Leiden) was said to contain "a collection of living plants richer in kinds and more varied in form . . . than might be found . . . anywhere else in the world." Prominent in development and teaching at the Leyden garden were such renowned names as Rembert Dodoens (Dodoneaus), Charles de l'Escluse (Clusius), and Mathias de l'Obel (Lobelius). Such monumental works as *Rariorum Plantarum Historia*, and *Exoticarum Libri decem*, connected for example with the efforts of Clusius, have proved of lasting importance to systematic botany. Introduction by this garden of many bulbous plants led to founding of the bulb industry of Holland, thereby indicating an economic value to be found in botanic gardens—historic as well as modern.

At about the same time, the wealthier merchants were establishing beautiful gardens, with seeds and bulbs collected in foreign travel by their various ships' captains. Such gardens played an important role in plant introduction, though many of them are nearly anonymous historically, as gardens or as scientific institutions.

At the *Botanischer Garten*, Berlin-Dahlem, in 1679 one of the first exhibition gardens was established, thus demonstrating another important function of modern botanic gardens: exhibition of collections to the public. A further distinction came much later, with its sponsorship and publication in 1887 of the monumental work on plant classification, *Die Natürlichen Pflanzenfamilien*.

Over the years, then, from the earliest gardens of record, one may observe formation of purposes which correspond to and are eventually found in the objectives of the modern botanic garden.

ORIGIN AND DEVELOPMENT

OF SELECTED REPRESENTATIVE BOTANIC GARDENS

For rounded understanding and appreciation of a modern botanic garden, answers to questions like these may contribute substantially: Who were the persons instrumental in initiating this project? What were their motivations and goals? What was of importance in selecting and obtaining the necessary land? What were the circumstances relating to plant collection? What major factors have influenced the development of the garden through the years?

The answers to such questions as these are presented here, with others unique to each of the gardens considered.

The Royal Botanic Garden, Edinburgh. Because medicine and botany were very closely associated in the mid-seventeenth century, it is not surprising that the Royal Botanic

Garden at Edinburgh, Scotland, owes its inception to two eminent Edinburgh physicians of the time. Influenced by the enthusiasm of Dr. Morison, the Professor of Botany at Oxford University, these men did much to promote the study of plants and of medicine. Sir Andrew Balfour and Dr. Robert Sibbald, through joint effort, established the garden in order that apothecaries might be able to learn something of the products which they sold. At the same time, with a view to providing his colleagues with reliable drug supplies, Sibbald began a study of indigenous plants from which the drugs could be derived; this study he did not confine to locally collected species. Several other physicians in Edinburgh concurred in the design and in financial support of the project as soon as land was made available for the garden. Care was taken,

. . . to embellish the fabrick of the garden, and import plants from all places into this garden, and procure that severall of the nobility concurred on contributing for some yeers . . . some gifts lykewise were obtained of mony from the Exchequer and the Lords of Session and Faculty of Advocates, for its use . . . considerable packets of seeds and plants were yeerly sent hither from abroad, and the students of medicine got direction to send thym from all places they travelled to, when they might be had, by which means the garden increased considerably every year . . .

Thus in 1670 the garden was established. In 1699 more land was obtained for the plant collections, which made possible the organization of informal beds, devoted to native and foreign plants as well as to medicinal herbs. Three years later systematic plantings were established adjacent to the College grounds, but in 1776 a permanent endowment made it possible to move the combined collections to a more suitable site.

This garden was established, then, for the purpose of collecting and cultivating medicinal plants in an endeavor to improve medical training, and to provide an accurate knowledge of plants which would serve as the sources of drugs. At the present, it has been increased in size to a total of sixty acres, and it has grown in value, scope, and purposes so that it is now said to be one of the finest gardens in the world, outstanding in its beauty.

The Royal Botanic Gardens, Kew, England ("Kew Gardens"). The Royal Botanic Gardens, at Kew, England, came into being because of the interest in horticulture of various members of the British Royalty and their amassing of plant species. Early in the eighteenth century, Kew Gardens became and for a hundred years continued to be the favorite retreat of the British Royal Family. For nearly two centuries, kings and queens, royalty of all degrees, famous courtiers, statesmen, scientists, and landscape gardeners have in their turn helped to extend and to beautify the garden.

Kew Gardens as they exist today are a combination of several properties. Only two of these, however, are said to be of chief importance: the grounds attached to Kew House and called Kew Gardens, and the royal gardens of Richmond. The rest comprise grounds of the present Kew Palace and Herbarium and the gardens that once belonged to a series of houses on the south side of Kew Green, now Crown property.

Richmond Gardens, composing the western portions of modern Kew, were the grounds of the royal residence of Edward I. The private grounds of Kew House were the possession of Lord Capel, who obtained the property at his marriage in 1696. Because he was greatly interested in the collection of plants, his collections there formed the nucleus of the modern Kew plantations.

When George II became King, in 1727, Queen Caroline undertook many costly and elaborate improvements in the gardens and grounds at Richmond. Her chief professional adviser appears to have been Charles Bridgeman, a notable landscape gardener of this time and an apostle of the so-called "natural school."

Shortly after the death of George II in 1730, the property was leased to Frederick, Prince of Wales. Soon after, the landscape gardener William Kent was employed "to

design ornamentation of the Prince's Villa at Kew." At the death of Frederick in 1751 the Princess of Wales took control of the property. Interested in horticulture, she added a botanic garden of exotic plants which became a special feature of the grounds. In its planning, a third landscape designer was employed, known as Lancelot "Capability" Brown, and William Aiton, a former pupil of the Chelsea Physic Garden, was engaged as head gardener. In 1759 a large collection of exotic trees, which had previously belonged to the third Duke of Argyll, was transplanted to Kew. From this date forth, the status of Richmond as a true botanic garden has been acknowledged.

Finally the two properties were united under one ownership when George III bought the freehold of Kew House some time subsequent to 1772. Apparently they were not actually united until 1802; up to that time they were divided by an old foot road or bridle path called Love Lane, extending between Kew and Brentford. Up to the time of their union under the auspices of George III, the histories of the Richmond and Kew properties show no connection.

Sir Joseph Banks, famous naturalist, was chiefly responsible for the establishment at Kew of two objectives which are in operation at the present day: one, making Kew "a depot for the interchange of plants with Colonies . . . which must prove of great advantage to the commerce of these kingdoms"; two, realizing that the colonial expansion of England would require men trained for botanical and culturist service abroad. He saw clearly that Great Britain would require the aid of a national botanical establishment for the scientific exploration and material development of the future colonies and his aim was to secure this at Kew under royal protection. However, the decay of the King's mentality was such as to frustrate hopelessly Banks' intentions. The two men died in the same year. Apparently, however, Sir Joseph did the best thing possible under the circumstances: he left the Colonial collections, control of which he had been permitted to retain, along with the papers relating to them and his library as well, to the safe custody of the British Museum. He had not labored altogether in vain. The decay into which the garden fell brought such protests from the English scientific world as ultimately reached the throne. As a result, a committee was appointed to present a report to Parliament. This report was intended to guide Sir William Hooker, the newly authorized director. Among its recommendations are these:

A national garden ought to be the center round which all minor establishments of the same nature should be arranged . . . receiving their supplies, and aiding the Mother Country in everything that is useful in the vegetable kingdom. Medicine, commerce, horticulture, and many valuable branches of manufacture would derive much benefit from the adoption of such a system. From a garden of this kind, Government would be able to obtain authentic and official information of points connected with the founding of new colonies; it would afford the plants these required.

Until 1840, then, Kew belonged to the Royal Family; in 1841 it was taken over by the government as a public scientific establishment. Kew has exerted a profound influence on the development of botanical science. By the training of gardeners, by the discovery of many plants with economic and ornamental importance, Kew has made possible the development and work of numerous colonial gardens and botanical stations. While the latter are in actuality experiment stations, they depend upon Kew for scientific advice and for much economic plant material.

The beauty of Kew can be traced to the efforts of Sir William, so long associated with the garden. He sought to make Kew so attractive as to create in the general public an interest in plants as well as to advance pure and applied botany and to train collectors and gardeners.

Indian Oak of Interest

ROSS GOODRICH

An oak from India, *Quercus incana*, has begun to attract attention in the Arboretum. For a long time unnoticed, it is now large enough (18' tall) to show its character and charm. Its color at first glance is similar to the native live oaks, but darker green, and in a breeze the undersides of its long leaves give the tree a silver effect. This specimen, one of three seen in the valley area, seems to be characteristic in shape; it is slightly ovoid with an open framework of branches. It has been evergreen, shedding its leaves in a short period in the winter when most of the new growth is coming on. In the search for plants to fill specific needs this oak would seem to be ideal for the patio.



Quercus incana, an oak worthy of more attention and use; however, patience is needed for its culture.

Photo: Denis Kucera

Its good features: slow enough growth to be easily controlled (about 2' per year), a dense enough shade to be really cooling, discreet enough about dropping leaves to be used on a terrace or near a pool, and few natural enemies. The only damage so far noticed has been a slight chewing some years by fuller's rose weevil.

The tree is native to the temperate Himalayas of India, at altitudes of 4,500-7,000 feet, where it reaches a height of 80 feet.

Source of the Arboretum specimen: Willard Hagen.

Arboretum Gardener

Pacific-Asiatic Section

THE HUNT BOTANICAL LIBRARY

Carnegie Institute of Technology

The Hunt Botanical Library at Carnegie Institute of Technology, Pittsburgh, Pa., celebrated its formal dedication and opening on 10 October 1961.

This library, founded by Rachel McMasters Miller Hunt (Mrs. Roy A. Hunt), comprises a series of interrelated collections: books, botanical prints and paintings, portraits of botanists and their autograph letters, and manuscripts. The books, numbering in excess of 8,000 volumes, are mostly botanical and horticultural, but also well represented are the herbals, early agricultural works, and volumes on bibliography, the graphic arts, and the fine arts.

Originally a private botanical library—it is believed to have been the largest of its kind in the world—it is now a separate administrative unit of Carnegie Institute of Technology and is directed by George H. M. Lawrence. Its program for research and service has been formulated to develop it as an international center for bibliographic work in the fields of botany and horticulture.

The collections and work spaces occupy about 10,600 square feet of area which comprises the penthouse of The Hunt Library building, a five-floor building given by Mr. and Mrs. Hunt. The lower floors of the building serve as the main library of the university.

The Hunt Botanical Library has a staff of nine, including a full-time master book-binder who operates a fully equipped bindery for restoration and conservation of its rare works.

The Library program follows recommendations of an Advisory Committee, which is composed of six specialists and the trustees of The Hunt Foundation. The specialists are:

Mr. John S. L. Gilmour, Director, University Botanic Garden, Cambridge, England;

Dr. Mildred E. Mathias, Professor of Botany and Director of the Botanic Garden, University of California, Los Angeles;

Dr. Rogers McVaugh, Professor of Botany, University of Michigan, Ann Arbor, Michigan;

Dr. Harold W. Rickett, Bibliographer, New York Botanical Garden, New York;

Dr. Reed C. Rollins, Asa Gray Professor of Botany and Director of the Gray Herbarium, Harvard University, Cambridge, Mass.;

Dr. Frans A. Stafleu, International Association of Plant Taxonomists, Utrecht, Netherlands.

On the recommendations of this Committee, Director Lawrence announces adoption and activation of the following projects:

1. Continuation of the *Catalogue of Botanical Books in the Collection of Rachel McMasters Miller Hunt*. Volume I of this Catalogue was distributed in 1958. Volume II was distributed early in November 1961. Volume III, now in progress, will be followed in close succession by two projected volumes that will comprise a Supplement.

2. The Hunt Facsimile Series will be launched in late 1962 with the publication of a substantial facsimile work. This Series will present facsimile productions of rare botanical and horticultural works, currently of importance but which are unlikely to be reproduced by commercial firms. Each production will include scholarly introductions and commentaries on the work itself, the importance of the author, bibliographical considerations, and its present day significance. It is probable that the first work will be one of broad appeal to both botanists and horticulturists and will be a rarity, important for both the quality and quantity of its color-plates. Announcement of the selection will be made in a few months.
3. A critical study of the publications, manuscripts, and correspondence composing the botanical library of Michel Adanson (1727-1806), a French student of de Jussieu and contemporary of Linnaeus. This collection, acquired by this Library in March 1961, will be the subject of intensive research for the next several years. Study is now being given to scheduling in August 1963 an international symposium to celebrate the bicentennary of the publication of Adanson's *Familles des Plantes*. Following this, two or more publications are projected to present the results of the investigation of Adanson and his work.
4. In recognition of the need for a journal to serve as a medium for future bibliographical studies of the plant literature, a yearbook will be published by the Library. This yearbook, to be named *Huntia*, is expected to reflect Mr. and Mrs. Hunt's tastes for fine printing. In content it will cover the range of the entire collection.



Hunt Botanical Library. The Rare Book Room.

Carnegie Institute of Technology photo

Its pages will be open to contributions by scholars in the field and substantial studies will be invited. To assure proper planning and carefully conceived typography and designs, the publication of the first volume is being deferred until the autumn of 1963.

5. The Library proposes to actively develop Mrs. Hunt's significant collection of portraits of botanists. This will be accomplished by initiating, early in 1962, a project to invite the centralization of existing collections of photographs of contemporary botanists and horticulturists now held by scores of interested persons who have developed personal collections as a hobby. This will be done in large measure through arranging for duplicate copies to be deposited here, whenever the originals are to remain in private hands. In addition, the Library proposes to solicit photographs of living botanists, and those recently deceased, so that a central fine may be assembled and be available for the future.

An Entomologist Abroad

J. ALEX MUNRO

An entomologist who goes abroad on foreign service encounters problems somewhat different from those he experienced in his homeland. The patience and understanding he shows will determine to a large extent his effectiveness.

First of all, upon assuming a foreign service post, the entomologist as well as the members of his family are confronted with a new language, strange customs, foreign currency, and occasionally somewhat confusing auto traffic regulations. You can add to this the new terminology and problems he meets in economic entomology to appreciate more fully the situation. A sound background in his profession, a working knowledge of the language (or at least a strong desire to learn it), a fair sense of humor and the ability to get along with people will contribute greatly to his success.

Having recently returned to the United States after spending some nine years with the U. S. Government technical assistance program in underdeveloped countries, I believe that some comments will be of interest, particularly to anyone who is contemplating service abroad.

The over-all assistance program, conducted under the direction of the International Cooperation Administration (ICA) deals largely with agriculture, education and health problems in upwards of 60 countries of the world. Close cooperation, financial and otherwise, between the United States and the host governments contributes greatly to the success of the work. The prime objective of the program is to help the people of those countries to help themselves. The duty of the visiting entomologist is to impart to them, through subject matter counter-parts in the host government, the "know how" on crop protection. It is most important that he make full use of these associates. They should, by all means, engage in giving the method demonstrations to the farmer groups and do most of the public speaking. The American entomologist's responsibility should be primarily that of training the host country personnel so that they are prepared to carry on after American aid is phased out.

Ordinarily it will require time for the visiting entomologist to become familiar with the more important crop protection problems, obtaining equipment and pesticides for control demonstrations, and planning what should be done. While such preliminary work is in progress it would be well to begin the collecting of representative specimens of crop and livestock pests of the host country and get them identified. The specimens can serve to advantage in building up a reference collection which is essential to any country. The Insect Identification Research Branch of the USDA, has been most cooperative and efficient in identifying such material. There is an added advantage of

having specimens confirmed by this identification service as it serves as an important source of information on potential pests which are not as yet known to have invaded the United States.

While the visiting entomologist will do well to encourage his counterparts to lead discussions and demonstrate modern methods of pest control, he should be constantly on the alert to further the program through developing cooperation with agencies that can be helpful. This requires tact and good judgement. He should see to it that there is adequate publicity on the work. Wherever press, radio or TV facilities are available, they should be used in giving advance notice of meetings. In the treeless, high-plains area of Bolivia where such facilities were lacking, the Bolivian flag was displayed from the top of a high pole at the site of the meeting-place some hours in advance to notify the Campesinos of a meeting requiring their presence. The method was effective and standard procedure in that area.

Cooperation from all agencies that can contribute help is particularly desirable and should be encouraged. Schools, civic groups, missionaries and others have been highly effective in aiding work of this nature. During the early 1950's when field rats destroyed over 60 percent of the growing corn and rice in an important food producing area in the Philippines, all agencies lent their cooperation in a control campaign, which succeeded in reducing the annual rat damage to less than 2 percent.

In addition to cooperation, there is need for coordination. Such coordination was well demonstrated in the Philippines where the three main agencies concerned with plant protection, the Bureau of Plant Industry, the Bureau of Agricultural Extension, and the College of Agriculture, operated as a unit in conducting the crop pest control program. To expedite the program, the officials encouraged the development of farmer "Pest Control Groups." Within two years from their beginning in October of 1955, they had succeeded in the formation of over 6000 such groups throughout the 53 provinces of the country. Purchase of spray equipment and pesticides, at savings to the members, by these cooperative groups helped the membership. The members received a quarterly newsletter, titled "Crop Protection News" published jointly by the three coordinated agencies.

The most important insect control problem of the Philippines dealt with rice stem borers and related pests. Yields from over 1300 spray demonstration plots, located along highways in the main rice growing areas, showed the sprayed areas to have yielded approximately 40 percent more rice than similar adjoining unsprayed areas. Such demonstrations served as indisputable evidence of the value of spraying, and emphasized their importance in providing useful information for the growers.

Some of the problems though non-entomological were never-the-less observed in the crop protection program. The destruction of crops by monkeys and wild pigs on the islands of Jolo, Tawi-Tawi and others, was claimed to be of greater consequence than the insect problems in this Sulu Archipelago. When I visited the area some farmers were doing a thriving business by trapping the monkeys and selling them for export to the United States for use in Salk polio vaccine production. The monkeys were lured with bananas into bamboo or rattan constructed cages from which they were removed by the farmer. Some progress was being made in protecting crops against the nocturnal invasions of wild pigs by destroying them with poisoned baits. Agricultural officials, however, claimed that this was an endless and discouraging task because of fresh invasions continually drifting in from northern Borneo on strong ocean currents. The nearest of these islands to the Borneo coast approximated some 20 miles. A government veterinarian, whose work took him to the islands, told me that he had on various occasions encountered the floating droves, some containing upwards of 100 pigs, drifting on prevailing ocean currents.

In contrast with the country by country crop protection assistance, as obtains for most

of the under-developed countries being helped, the regional approach has had an interesting development. This phase of development began in 1951 with United States emergency aid to Iran in controlling extensive swarms of crop destroying locusts. The successful control obtained, using modern insecticide sprayed by airplane, led to the program being rapidly extended to India, Pakistan and other countries of the Middle East and later to North Africa. By 1954 the scope of the work had expanded to justify changing the project name from Regional Locust Control, to Regional Insect Control.

The Regional Insect Control Project holds its annual meetings, usually in its Beirut headquarters, at which time its entomologists assemble from the different countries where the project operates in the region, for a week of discussions on crop pest control problems and plans for the following year.

Whether the crop protection phase of the technical assistance program is administered on the regional or the individual country basis probably makes little difference in its effectiveness or accomplishments. The ultimate object of either system remains the same; viz, to teach and encourage the people of under-developed countries to help themselves. The work is interesting and rewarding to any entomologist abroad who derives satisfaction from helping humanity and seeing modern methods of crop protection being adopted and put into practice.

An 'Educational' Picture Story



"By the bus load they come to learn, and . . .



"Under native oaks, surrounded by camelias, the trained guide instructs, and . . .



"The wild (native) horticultural subjects tie the past with the future, and . . .



"The classroom visit often inspires membership in special nature study classes at the Arboretum and Descanso Gardens."



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Ghost Gum

ROSS GOODRICH

Although it came to the Arboretum under another name, this beautiful tree is probably *Eucalyptus pauciflora*. Commonly called Ghost Gum, its white trunk and branches make this name more fitting than most common names. Its startling white trunk turns to silver late in the year. This tree has yet to bloom. Its grey-green leaves are 5-6 inches long, they hang gracefully from the branches and are set widely enough apart for the tree to give very light shade. The branches are so evenly spaced that no pruning has been needed above the lower part of the tree. Planted in 1950, it is located in the west acres up near Golden West Avenue, where with a spread of forty feet and height about the same, it will soon be a feature of the skyline. None of the usually expected mess of leaves and twigs is ever found under this one and it is hoped that future plantings of it bear these same good features.

Arboretum Gardener
Asiatic-Pacific Section



Ghost Gum, *Eucalyptus pauciflora*, twelve years old, about 40 feet tall. Photo: Denis Kucera.

Professional Gardener School

LOUIS B. MARTIN

One of the main responsibilities of arboreta and botanic gardens is to offer training opportunities in practical horticulture and gardening. There are *still* young men and women who have a love of plants, and who want to get their hands dirty, working with these plants they love. They look forward to becoming skilled plantsmen in such lines of work as: propagation, greenhouse management, park superintendent, greens-keeper, estate gardener, etc. Few schools, at least in the United States, offer or are equipped to furnish the type of "on the job" knowledge desired by the nursery industry in the people they hire. The Professional Gardener School of the Los Angeles County Department of Arboreta and Botanic Gardens offers a curriculum which is planned to orient the student in botany and horticulture and also supply the practical experience.

This article is written with the hope of accomplishing several things. First, it is the format for a syllabus we will send to students wishing to register in the School. Second, in reporting what we have been doing and learning during two years of operation, we seek constructive suggestions from our readers. Third, although there are still shortcomings in our program, which only time will correct, we offer our program as a model and as encouragement to other arboreta and botanic gardens to initiate educational programs of their own. We feel that if arboreta and botanic gardens are encouraging nurseries and the public to grow and use better plants, they also must insure a supply of better trained skilled labor.

In the United States today, we preach the development of the good, the beneficial and the beautiful in everything we do. But it is a fact that young people are not entering the horticulture field in large enough numbers to even replace those who are retiring. Why? We think part of the answer may be: 1) These young people know little of the careers possible in such work. (Why aren't schools being urged to help by broader career surveys?) 2) Relatively few schools have the type of courses filling the need of these young people. (Why the lack of emphasis on horticulture when skilled trades training for many of our other needs find adequate space in the curriculum?) 3) The nursery industry in general, as competitive as this business has become, cannot afford to set up training programs of their own. (This can't be the only reasons, however, for in other parts of the world, nurseries of reputation do have training programs.) 4) The job of a skilled gardener, in the United States, has lost the prestige and public respect it still enjoys in other countries. The public, willing to settle for much less by using a "gardener" who drives up in his pick-up truck, rolls out his power tools and begins "gardening," are partly to blame for this present situation of a second-class reputation for horticulture. At least public-owned arboreta and botanic gardens should be rising to the challenge in this regard, to better serve the communities which support them.

Our School's modest beginning was thought superior to no beginning. On this basis, the School was established along lines of a simple program. Currently, it operates as follows:

Headquarters:

Los Angeles State and County Arboretum, 301 N. Baldwin Ave., Arcadia, California.

Program:

- a) Half-day sessions, 8:00 A.M. to Noon, Monday through Friday, for one year.
- b) The term begins the second week of September and terminates the last working day of July.
- c) Six hours a week for Lecture Phase.
- d) Fourteen hours a week for Practical Phase.
- e) Lecture and Practical Phases supervised and taught by Department staff members.
- f) There is no fee to the student.

Registration:

- a) Minimum age of 17.
- b) High school graduation minimum education.
- c) Demonstrated interest to enter horticulture and gardening as a career.
- d) Oral interview with Department staff.
- e) Must furnish own transportation.
- f) Must furnish own books, work clothes, etc.

Curriculum:

Lecture Phase
(30 hours each subject)

General Botany
Plant Identification
Plant Propagation
Floriculture
Soils & Fertilizers
Plant Pathology
Entomology

Practical Phase

Greenhouse work
Lathhouse & Nursery
Rose Culture
Camellia Culture
Field Planting
Pruning
Commercial Wholesale
Nursery Experience

A certain amount of extra curricular activities are included, particularly to show the student the applied horticultural opportunities:

Attendance required:

- Annual Southern California Turfgrass Conference
- Annual Southern California Nursery and Turfgrass Equipment Display
- Annual Southern California Pest Control Operators' Conference
- Annual California Association of Nurserymen's Meeting
- Annual Camellia Show (Descanso Gardens)
- Annual Orchid Show (Arboretum)
- Annual International Flower Show (Los Angeles)

Field Trips to:

- Huntington Botanic Garden, San Marino, Calif.
- Rancho Santa Ana Botanic Garden, Claremont, Calif.
- UCLA Botanical Garden, Westwood, Calif.

In an attempt to build and maintain standards throughout the instruction hours of both the Lecture and Practical Phases, the following set of suggestions are given to the staff member teachers:

1. Suggest at least one reference book in the subject presented and ask the students to purchase the book.
2. During lectures, use actual plant materials, insects, fungus specimens, soil samples, chemicals, etc., for visual aids.
3. Give periodic tests, so that students and instructor alike can judge the amount of material they have covered and the portion retained.
4. Each new phase of a lesson means new relationships to the student. All questions relevant to establishing this new relationship are important. What is obvious to the expert often is not so obvious to the novice.
5. Stress thoroughness in lesson or work, rather than quantity. Stress discipline of doing the job right.
6. Stress safety in every operation. Stress neatness and clean-up in finishing a job. Point out hazards, both to themselves and to the Arboretum, resulting from inattention to correct ways of doing the job.
7. Always tell the students:
 - a) What the lesson or job includes.
 - b) Why they are doing it.
 - c) What is the expected end result.
 - d) How the lesson or work fits into the total concept of gardening.
8. Remember, the students want to learn. Teach them to use their eyes, ears, nose, hands and mind—at all times to accomplish their goal.

The first week that the School is actually in session is spent in familiarizing the students with their surroundings. They are taken on a walking tour of the Arboretum grounds, greenhouse and nursery area, administration building; introduced to the various staff members they will encounter during the weeks ahead and briefed in the general policies governing the operations of our Department. We try to make them feel at home, as quickly as possible.

During this time, the Library comes in for close examination. We ask the student and encourage him at all times to use the library as frequently as possible during the school year. The Librarian takes the students on a tour, explaining the card file system, the stacks, periodicals available, etc. Each student is given copy of the rules governing the use of the library.

The second week the students are given their Lecture and Practical Phases program schedule, which covers their training time, day by day, for the first three months. Their adventure in gardening and horticulture has started.

SYLLABUS OF LECTURE PHASE

I. GENERAL BOTANY: Dr. L. B. Martin

A. Purpose: A plant is a living organism. Considering the individual plant, it is the sum of many separate parts; and, for optimum growth, these many parts must function correctly, all at the same time, in order to give a plant unity in its life processes. The student at the outset of working with plants, must be impressed with this basic concept. The course must supply a background of fundamental botany and clarify its connection with practical plant culture.

B. Outline of Lectures:

1. The Whole Plant: What you now know about plants, and how you can apply this knowledge as you begin your year's study.
The Plant Kingdom: Emphasis on Gymnosperms, Angiosperms.
The Divisions of Botany: Taxonomy, Morphology, Anatomy, Physiology.
 2. The Root: Survey of its anatomy, method and manner of growth and its function in relation to the whole plant.
 3. The Stem:
 4. The Leaf:
 5. The Flower:
 6. The Seed:
- } Lecture coverage similar to that for the Root.
7. The Cell: Structure of a generalized cell; special features of certain cells; cell growth needs.
 8. Pollination, Fertilization and Cell Division.
 9. Water: Its uptake, translocation through the plant and function in the life of a plant.
 10. The Nitrogen Cycle: Of all plant nutrients, nitrogen or the supplying of nitrogen is of singular importance to plantmen.

II. PLANT TAXONOMY: Dr. Leonid Enari

A. Purpose: An introduction to plant taxonomy and an orientation into the techniques of plant identification, including: use of 'keys', sample collections and field trips.

B. Outline of Lectures:

1. Introduction. Flowering plant organs. The leaf: types, forms, arrangement, margin, surface, leaves of unusual form and function.
2. The Flower: parts of a typical flower; sepals, calyx, petals, corolla, stamens, pistils, ovary, style, stigma, ovules.
3. Flower formulae and diagrams. Inflorescences.
4. How to describe a leaf. How to describe a flower. How to describe a plant.
5. The fruit and seed.
6. How to use plant keys and floras.
7. The Plant Kingdom.
8. Taxonomical units: species, subspecies, variety, cultivar, form.
9. Important plant families and their characteristics.
10. Ornamental plants important in California nursery trade. 150 trees, shrubs, ground covers.
11. Common weeds: 50.

III. PLANT PROPAGATION: George Lewis

A. Purpose: To supply background knowledge in the various methods of plant propagation through a series of lectures followed by practical work, after each lecture, in the glasshouse and nursery.

B. Outline of Lectures:

1. Discussion and demonstration of the various pre-germination seed treatments for many plant species.
2. The importance of sanitary practices, such as: soil sterilization, sterilization of bench area and all tools used in handling soils and the eradication of soil fungus, other harmful pathogens and weed seeds.
3. Allowing each student to get as much practical knowledge by assignment in transplanting, "pricking off", flating and shifting up of plants in the greenhouse, lath-house and field nursery.
4. Practices in watering, fertilizing, pinching and disbudding of all plants that require this important and beneficial treatment.
5. Grafting experience is a must in any course of this type. A great deal of time is spent in lectures covering the skill and art of grafting. Equal time is spent in demonstrating the different grafts, the selection of both scion wood and rootstock. Each student is required to perform each graft which is discussed in the classroom.
6. The mixing of compost, soils and the preparation of seed beds are other propagation techniques which are carried out in a special program.

IV. FLORICULTURE AND GREENHOUSE MANAGEMENT: Quinn Buck

A. Purpose: To further broaden and round out the student's knowledge of propagation. Emphasis is on the production of flower crops, bedding plants, 'special season' flowers and particularly showy flowering woody plants.

B. Outline of Lectures:

1. Floriculture and flower marketing and use.
2. Structure of plants; production of new varieties; temperature and growth; light and growth.
3. Effects of gases; soils and fertilizers; water uses and application.
4. Propagation of plants; cut flowers; potted plants; troubles.
5. Structures for greenhouse plants.
6. Chrysanthemums.
7. Poinsettias.
8. Gardenias, roses.
9. Hydrangeas, Easter lilies; snapdragons.
10. Cinerarias and calceolarias.
11. Miscellaneous floricultural crops.
12. Floral art.

V. SOILS: Francis Ching

A. Purpose: To supply basic knowledge concerning the role of soil as the growing media for plants.

B. Outline of Lectures:

1. Plants: physiology, uptake of soil solutions; conditions, both external and internal to the soil, affecting plant growth; watering.
2. The chemical, physical, biological, pH structure, salts, etc., of the soil.
3. Necessary nutrients for plant growth.
4. Importance of organic matter. Life cycle, such as the nitrogen cycle.
5. Fertilizers, their cost and ways of application.

VI. PLANT PATHOLOGY: Dr. James P. Martin

A. Purpose: To give students an elementary understanding of the nature of plant disease, causes of disease, control of such problems. Illustrations as well as diseased plant material augment discussion to assist the student in recognition and study of various plant diseases. Specific examples point out the various problems due to animate as well as inanimate causes.

B. Outline of Lectures:

1. Crown gall of roses, fire blight of pyracantha and others illustrate clearly how much damage is done by bacteria.
2. Various fungi responsible for plant injury are viewed both from the standpoint of individual characteristics as well as their role in disease development. A number of important fungus diseases such as root and stem rots, wilts, and blights found in California and elsewhere are described.
3. Information concerning the many plant diseases caused by viruses and nematodes add an important part to the course.

4. Attention is given to many of the non-parasitic problems including heat damage, inadequate soil moisture, air pollution, wind damage, and nutrient deficiencies.
5. The importance of resistant varieties in plant disease control is explained along with a discussion of cultural and chemical control measures being used today.
6. Throughout the course, additional sources of information concerning plant disease including latest control measures are furnished.

VII. ENTOMOLOGY: Dr. Alex Munro

A. Purpose: To provide students with basic information needed to deal with insect problems encountered in gardening and related horticultural activities, and to point out the advantages of adopting pest control procedures.

B. Outline of Lectures:

1. Takes into account the life habits, development, and identification of the more injurious insects as well as those which are beneficial. The latter include the pollinators which increase the yields of seed and fruit crops, and the parasites and predators which aid in controlling injurious species.
2. All types of applied control are discussed. The insects are considered in orderly sequence and their distinguishing characteristics are presented to aid in their identification. Charts and other illustrative materials are used.
3. To acquaint students with insects in their natural habitats, two or more field or collecting trips are taken during the period of the course. The insects collected include those which cause plant galls, or otherwise invade the plant tissue, such as leaf miners, bark beetles, and wood borers, as well as those which suck the sap or feed directly on the foliage.
4. Special attention is given to the pests which affect shade and ornamental plants, trees and shrubs.
5. The injurious forms discussed include the crickets, thrips, true bugs, aphids, white flies, scale insects, wireworms, white grubs, cutworms, ants, sawflies, etc., and how to control them.
6. The role of beneficial insects in giving protection and increasing the productivity of plants is pointed out.

SYLLABUS OF PRACTICAL PHASE

For individuals, not interested in college training, the opportunity for employment in plant work still centers, to a large degree, on practical knowledge and experience. To this end, 70 percent of the School program is devoted to practical training. This includes greenhouse, nursery, field planting and general plant maintenance work.

The development of this Practical Phase has been guided by several considerations. First, it had to fit into the established work pattern of the various garden and nursery sections, so as not to tax, too heavily, the time or supplies of the staff who serve as instructors. Second, we felt that it must lead the student, because of his limited knowledge of plant work, step by step, from the simplest job to the more complex. Third, by studying the Arboretum's year after year general work programs, we found that many jobs occurred about the same time each year. This furnished a seasonal timetable for scheduling certain field jobs. And finally, meeting with the potential instructors, the limits of what could be accomplished in the available time for each practical job were decided.

Evaluation of these considerations showed that for our circumstances, the Greenhouse Nursery was the logical beginning area.

The Propagator and Nurseryman share the job of instruction. A total of about 184 hours is spent in this area from September through November. Work experience includes: sanitation practices; flating seeds and transplants; shifting plants from one container size to the next; watering; soil mixing, soil sterilization; balling out, etc. A special project is the cultural details of preparing "Mums" for our fall flower displays. The "Mums" are started the previous spring by the students of the preceding class.

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At the end of November, the students are ready for a change of jobs. So far in our experience, December is a transition month for assigning the students to a "next step" job. Also, they are given a week's vacation starting with Christmas. Therefore, during this short month, students are assigned to our Geographical Plant

Sections, the Orchid Houses or the Display Gardens. In each of these areas, an Arboretum Gardener acts as the instructor. (See Projects for Training Student, etc.)

In January, the students are moved to Descanso Gardens for the month. Located in La Canada, California and a facility of our Department, Descanso Gardens contain about seven acres of roses and some 100,000 camellia plants. Here the students learn the art of rose pruning and camellia growing. The collection of roses ranges in types from the old-fashioned and historical roses through the most current AARS winners. Bush, climber and pillar rose plant forms are available for the teaching situation. Trained staff rosarians, taking the students in groups of two or three, guide the neophytes in getting more than a scratching acquaintance with rose culture.

Alternating with the rose work, time is given to instruction on the basic facts of camellia care. The students plant seedlings, desucker older grafted plants and propagate new seedlings by bud grafts. January is often a rain month. The days of rain are spent in informal lectures, conducted by the Superintendent, Mark Anthony, covering in more detail the practical culture of roses and camellias.

Pruning instruction continues at the Arboretum in mid-February. This time the class subject is our deciduous fruit and nut trees. The instructor for this phase is either our Chief Horticulturist, Don Woolley, or a Seciton Gardener. Demonstrations of the proper tools and techniques are followed with the students taking over the job of finishing the pruning of the various collections.

This training usually terminates at the end of February or the first week in March, depending on the weather. The next training step is the "on the job" experience in a commercial nursery.

March and April find southern California growers in the middle of their busy season. Our cooperators are wholesale nurseries or companies which contract for large scale operations, rather than the home owner business. These firms seem delighted to take on an extra hand at this time. For the student, this period has special significance.

There is a demand for production versus time in the commercial field not found in an arboretum. Under such stress, the student can question his own motives about really entering this work as an occupation. He can also put himself on exhibition for consideration as a potential employee, once his courses are finished at the Arboretum. It often points out what further training he needs before applying for a particular nursery job.

The arrangements made with the cooperators are that the student is to be treated as any other employee, except he receives no payment. Experience and instruction are the desired goals. We ask that the student be shifted from job to job, so that he will come in contact with as many phases of the work as possible. The required time of the working day is the same as at our School proper. In some instances, the students have stayed on during the remainder of each day. Whether or not they receive compensation for this time is a matter between the cooperator and the student.

When the students return from their commercial experience, it is quite evident that they are not the novices we began with in September. A new respect for the type of training they are getting and their possible future is apparent in the way they take to their next assignment.

The month of May finds the students once again in the greenhouse/nursery. Their special project is the preparatory steps in producing next fall's "Mums". They finished the project in the beginning months of their training. Now they start a new planting, for next year's students. Making cuttings, planting, tying up, disbudding; these steps will occupy part of their time from May through July.

The roses are beginning to bloom anew at Descanso Gardens by June. Having learned the secrets of pruning, the students now return to learn the art of summer care for roses. Their daily instructions and work cover: watering, mulching, insect and disease pre-

vention and treatment, pruning suckers and cutting off dead flowers.

July is the last month of the School year. The students come back to the Arboretum. Plant work reaches a low ebb because of the hot, dry summer weather and staff vacations. Now the students can be tested in the field, for they serve in a limited way, as vacation replacements. They are under the guidance of the Chief Horticulturist during this time.

Graduation for our students is the last working day of July. Some students go on to college; the others begin looking for employment. Both we help get started as much as we can. This is one phase of the program needing further development.

What we are attempting with our School can be done by any arboretum or botanic garden. It will be accomplished in a different manner in each instance, guided by the limitations of the institution and needs of the community to be served. The quality of the knowledge gained, related to the time available for training should be the criteria of success of the program. Not the number of students registered.

PROJECTS FOR TRAINING STUDENT & PARK MAINTENANCE MAN HELPERS

These suggestions were made by the Department Gardeners.

1. Preparation of soil for planting: beds, individual plants, lawns, use of composts, fertilizers and other additives
2. Planting and transplanting
3. Pruning: dormant and evergreen—trees, flowering shrubs, roses, vines, budding and grafting
4. Weeding: including chemical treatment, explain reasons for weeding and advantages of proper weeding, use of some weeds to improve soil
5. Watering: frequency; how to determine needs of plants
6. Feeding: individual plants, beds, trees, including special treatment of sick plants, mulching
7. Grading: leveling beds, preparation for lawns, landscape grading, drainage
8. Care of tools; cleaning and sharpening
9. Tying and staking: to prevent falling and breaking, to re-shape, tying for no damage to plants
10. Pest control: spraying, rodents, snails and slugs
11. Labelling
12. Lawn care: weeding, watering, fertilizing

In connection with the above, all gardeners have tips on the following subjects that they have learned from experience—better ways of doing things that are very much worth teaching new gardeners:

Observation of plants: growth, watering indicators, color, insect pests, general condition

Organization of work: day to day; seasonal

Records: of care and treatment of plants especially in regard to fertilizing and special soil additives, time of year done, spraying

Chief, Education Division

Soil Analysis

FRANCIS CHING

Soil, whether we find it in our backyard, on a farm or in an orchard is not a static system merely for the purpose of anchoring a plant or to provide a media to grow in but is a living, dynamic system that is always changing. A good soil possesses adequate or free drainage, the capacity to hold plant food in a form available for plant needs, maintains a favorable acid-alkali relationship and does not possess large quantities of soluble salts.

Soil analysis is a diagnostic tool used to determine the fertility and productivity potential of a soil. The results of a soil analysis and the interpretation and recommendation for correction are important factors in the restoration and/or maintenance of soil productivity. However, a soil analysis is only useful if the recommendations are intelligently implemented by management or the individual.

All plant growth is dependent upon the presence, up-take and utilization of certain basic elements. Chemical analysis indicates the kinds and amounts of chemicals present in the soil. The amount of the particular elements needed varies greatly depending upon the species of plant, stage of growth, climate, etc. Excessive amounts of any one element can be just as harmful to plants as deficient amounts. Thus, large applications of nitrogen may cause excessive vegetative growth in plants where root growth is most important; likewise, extremely small applications of certain essential elements such as boron may be toxic to plants. Excess or deficient amounts of any of the essential elements will cause abnormal growth and result in production of poor flowers, foliage or root crops.

Excessive amounts of alkali and soluble salts are detrimental to optimum plant growth as they tie up nutrient elements present in the soil in such a manner that they are not available to the plant roots. In addition, high alkali may cause soil particles to separate in such a manner that poor soil aeration and drainage result. While such conditions can be corrected, it is desirable that this be done gradually so that sudden and drastic changes will not seriously affect the desirable microbial population of the soil.

The sand, silt and clay content, as well as the moisture holding capacity and permeability of a soil, can be determined by a physical analysis. The information derived from these tests is essential in making an intelligent recommendation for a fertilizer and irrigation program as well as determining the need for soil amendments such as peat or wood shaving.

Those plants which we desire to grow do not live in a vacuum in the soil. They compete with other plants, (weeds), insects, and disease producing organisms, all of which are influenced by the chemical and physical structure of the soil. Many microorganisms in the soil, through their activity, exert a beneficial influence upon plant growth through their action upon soil structure and nutrient availability. It is essential that all these facts be kept in mind when making a soil analysis. The "quick soils test" as used by some nurseries and organizations in southern California is essentially a test devised in the east for eastern conditions and falls woefully short of a true soil analysis. Such a soils test does not determine the total soluble salts, the presence of alkali, the moisture holding capacity nor the nutrient holding capacity of the soil and determines the presence of only a few of the many essential nutrient elements needed for optimum plant growth. These tests are often designed to sell a product and the cure may be just superficial and not a permanent correction of basic underlying problems (of the real soil problem).

Thus, soil analysis is a series of tests used to determine the chemical and physical properties of a soil—through these tests, recommendations for fertilization, irrigation and soil conditioning are established for individual problems. However simple these tests may be, the interpretation of the results is not a routine matter and is usually complicated by the immense number of different conditions found in the soil and locale. Recommendations are equally difficult to make and cannot be made en masse but must be based on the merits of each individual case, since the past history of management will influence recommendations to be made.

In the final analysis, the correction of a soil problem is dependent upon how completely the individual or management follows the recommendations.

Research Assistant

Los Angeles State and County Arboretum

Arcadia, California

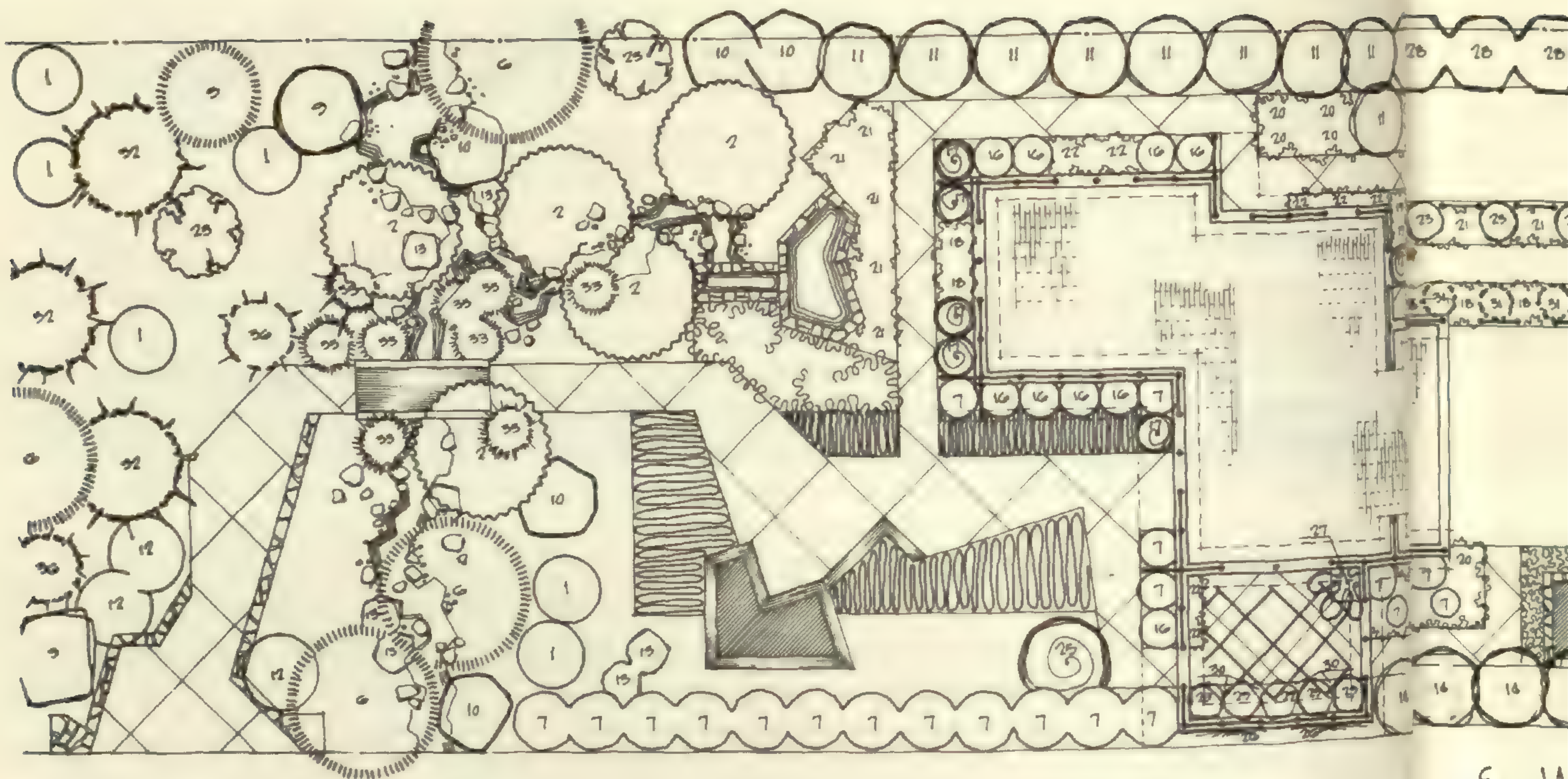
Rancho Santa Ana Botanic Garden

A HOME DEMONSTRATION GARDEN

This Demonstration Garden has been established to show visitors how native California plants can be used for landscaping their homes. In order to provide as nearly as possible the same types of situations as those found around homes in southern California, a garden structure has been built which simulates in size and shape a small house with overhangs, openings, patio, and service area. The demonstration garden itself is about the size and shape of a city lot. All the plants used are native to California and the species or hybrids were chosen with care. Foremost among the requirements was that they be relatively reliable as garden plants and that they could be expected to prove valuable in many areas of southern California. Some of the beautiful trees and shrubs which are to be seen in other parts of the Botanic Gardens have not been used, either because they sometimes prove to be temperamental under cultivation or they have not yet received sufficient testing to prove their worth as garden plants. In time new species may be added to the plantings, but only when it is believed that they will prove to be of general garden value. A second criterion was that the species used should be more or less readily available from retail nurseries. The landscape design and planting plan shown inside, give the exact location of all major trees, shrubs, and ground covers along with botanical and common names.



As visitors approach from the south, this is their first view of the Home Demonstration Gardens. The model "house" is located near the center of the landscape project. Photo: Douglas Ebersole.



SCALE



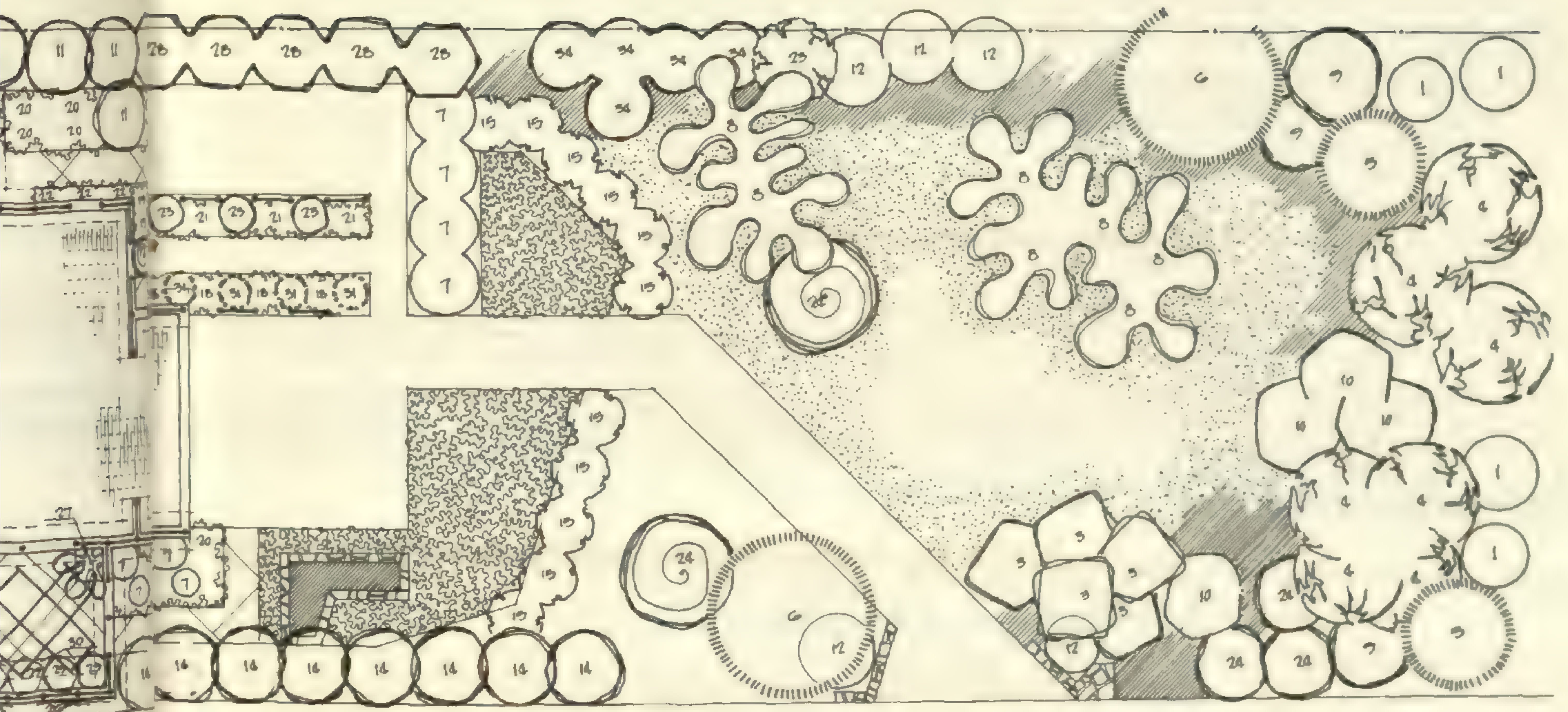
N O R T H



PLANT MATERIALS LIST

NO.	BOTANICAL NAME	COMMON NAME
1.	<i>Libocedrus decurrens</i>	Incense Cedar
2.	<i>Alnus rhombifolia</i>	White Alder
3.	<i>Lyonothamus floribundus</i> var. <i>asplenifolius</i>	Island Ironwood
4.	<i>Lithocarpus densiflora</i>	Tan Oak
5.	<i>Pinus coulteri</i>	Coulter Pine
6.	<i>Pinus radiata</i>	Monterey Pine
7.	<i>Torreya californica</i>	California Nutmeg
8.	<i>Platanus racemosa</i>	California Sycamore
9.	<i>Fremontia</i> 'California Glory' ..	Flannel Bush
10.	<i>Heteromeles arbutifolia</i> var. <i>maceocarpa</i>	Island Toyon
11.	<i>Prunus lyonii</i>	Catalina Cherry
12.	<i>Arctostaphylos densiflora</i> Sonoma Manzanita	
13.	<i>Arctostaphylos pumila</i> ...	Dune Manzanita
14.	<i>Rhus ovata</i>	Sugarbush
15.	<i>Myrica californica</i>	Wax Myrtle
16.	<i>Ribes viburnifolium</i> Catalina Evergreen Currant	
17.	<i>Berberis dideriana</i>	Barberry
18.	<i>Berberis redens</i>	Barberry

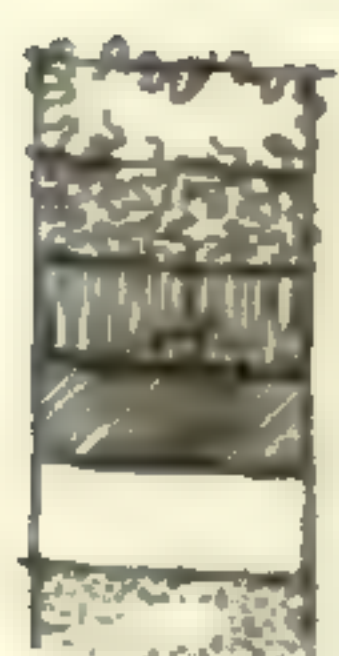
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C. JACQUES HANN - J. CHARLES HOFFMAN · LANDSCAPE ARCHITECTS

PLANT MATERIALS LIST

NO.	BOTANICAL NAME	COMMON NAME
19.	<i>Asarum caudatum</i>	Wild Ginger
20.	<i>Heuchera hybrids</i>	Alum Root
21.	<i>Iris hybrids</i>	Iris
22.	<i>Polystichum munitum</i>	Sword Fern
23.	<i>Umbellularia californica</i>	California Bay
24.	<i>Ceanothus</i> Species and Hybrids	
24.	<i>Ceanothus</i> Species and Hybrids	California Lilac
25.	<i>Ceanothus</i> 'Cal Poly'	California Lilac
26.	<i>Vitis californica</i>	California Grape
27.	<i>Woodwardia chamissoi</i>	Chain Fern
28.	<i>Comarostaphylis diversifolia</i> var. <i>planifolia</i>	Summer Holly
29.	<i>Rhododendron occidentale</i>	Western Azalea
30.	<i>Whipplea modesta</i>	Yerba de Selva
31.	<i>Berberis amplexans</i>	Barberry
32.	<i>Juniperus occidentalis</i>	Western Juniper
33.	<i>Juniperus communis</i> var. <i>saxatilis</i>	Dwarf Juniper
34.	<i>Arctostaphylos insularis</i>	Island Manzanita
35.	<i>Picea sitchensis</i>	Sitka Spruce
36.	<i>Cupressus bakeri</i> ssp. <i>matthewsii</i>	Siskiyou Cypress



Denotes *Ceanothus criseus* var. *horizontalis*

Denotes *Arctostaphylos edmundsii*

Denotes *Arctostaphylos viva-ursi* var. *coactilis*

Denotes Native Annuals and Perennials

Denotes Hybrid Ornamental Strawberry No. 25

Denotes *Dichondra repens*

Carmel Creeper

Little Sur Manzanita

Bear-Berry

Strawberry

Dichondra

Information on the care and handling of these plants may be obtained from local nurserymen and from numerous publications, some of them devoted entirely to California plants. The following list may be found useful.

Native Plants for California Gardens, Lenz

A Summary of the Culture of California Plants, Everett

The Sunset Garden Book

Sunset Magazine (especially the issue for October, 1961)

Journal of the California Horticultural Society, San Francisco

LASCA Leaves, Los Angeles State and County Arboretum, Arcadia

California Gardens, San Diego Floral Association, San Diego

Golden Gardens, California Garden Clubs, Inc., Los Angeles

Specific questions may be addressed to the Director, Rancho Santa Ana Botanic Garden, Claremont.

The demonstration garden and structure were designed by C. Jacques Hahn and J. Charles Hoffman, Landscape Architects, Sierra Madre, in collaboration with the Rancho Santa Ana Botanic Garden. Planting was done during the summer and autumn of 1961. The trees and shrubs were from one- and five-gallon cans. The stabilized adobe brick used for surfacing the structure is through the courtesy of Hans Sumpf Co., Fresno, California.

Coated Fertilizers

General Description and Applications

O. R. LUNT, A. M. KOFRANEK, AND J. J. OERTLI

University of California, Los Angeles

Reprinted from California Agriculture, December, 1961 and California Turfgrass Culture, January, 1962.

In the coating process, individual granules of inorganic fertilizers are coated with resinous, polymeric membranes. When such granules are placed in contact with water or moist soil, water passes through the membranes and dissolves some of the fertilizer. A saturated solution with considerable osmotic pressure develops within each capsule. The coated granules swell and become spherical in shape. Apparently the dissolved fertilizer materials diffuse through the membranes into the outside solution. The rate of diffusion is regulated by the thickness of the membranes and is relatively steady until about two thirds of the fertilizer has been released. The rate of transfer through the membranes is not markedly influenced by steam sterilization of soils or by other conditions occurring in soils, except dryness. The influence of soil conditions on diffusion rates will be the subject of a subsequent article.

Nitrogen (including urea), phosphorus, potassium, and mixed fertilizers can be coated. With some coatings, the minerals have been released over a period exceeding six months. A depletion time of 4 or 5 months is adequate for many crops.

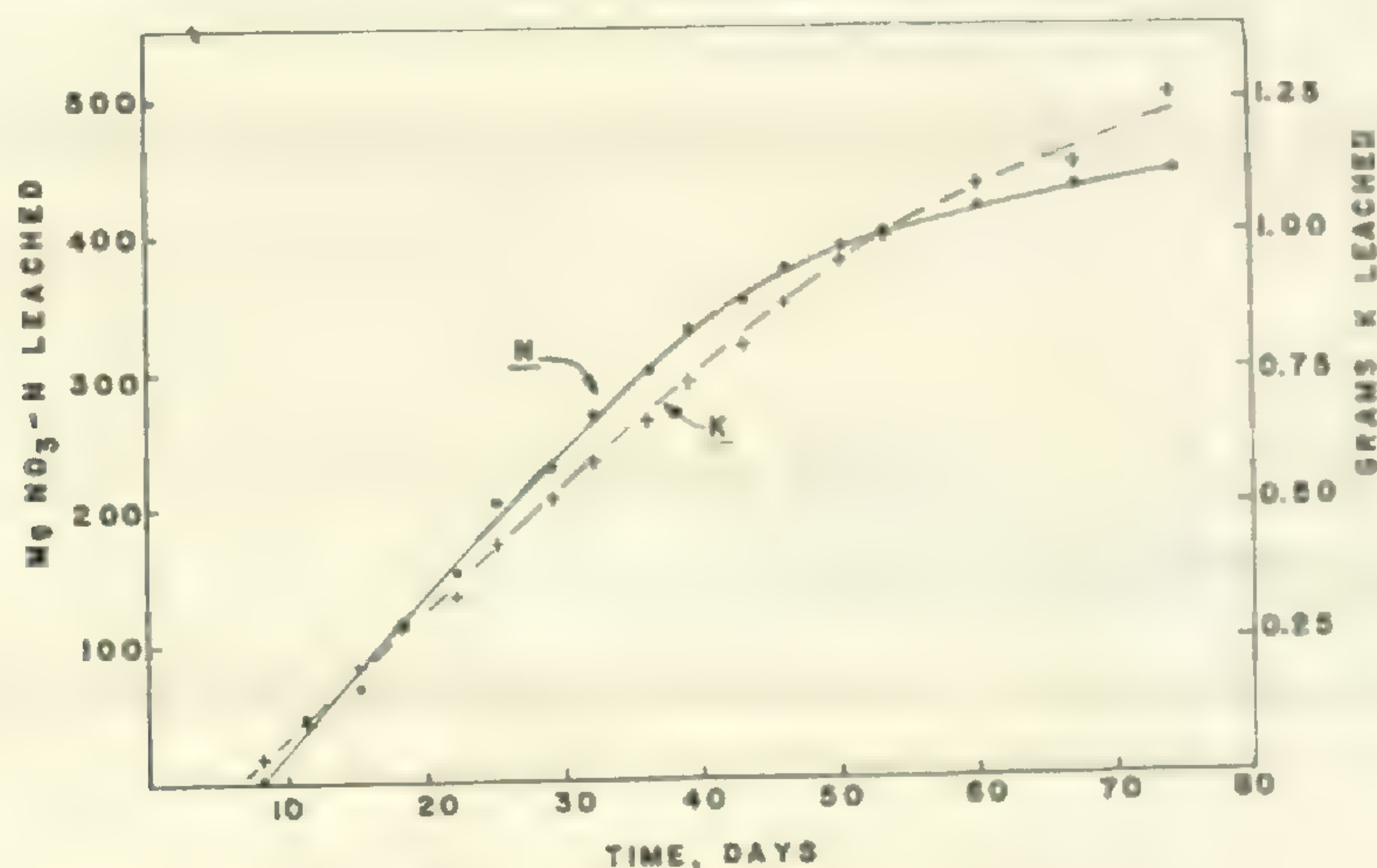
After all the minerals have passed through a membrane, the solution is withdrawn from the capsule, apparently by soil-moisture suction. The membrane shrinks, becomes brittle, and is easily crushed between the fingers. The swollen condition distinguishes coated particles which are still functional from those which are exhausted.

DURATION OF SUPPLY

To illustrate the duration of mineral supply from coated fertilizers, 500 granules of coated 20-10-5 fertilizer were examined after 112 days in soil with a growing crop. Of the lightly coated granules, 37.4 per cent were still swollen; of the medium coated, 49.6 per cent; and of the heavily coated, 58.2 per cent.

The graph shows cumulative quantities of nitrate nitrogen and of potassium released from a 60-centimeter column containing 30 grams of coated 10-10-10 fertilizer uniformly incorporated in 1 kilogram of krillium-treated soil. The column was leached every few

days. At the end of 74 days, some 68 per cent of the added nitrate nitrogen and 57 per cent of the added potassium had been recovered. On the graph, the relative linearity of the curve showing the amounts of minerals recovered demonstrates the utility of coating in sustaining the nutrition of a planting during a prolonged period.



Cumulative removal of nitrate nitrogen and of potassium by repeated leaching from 1 kilogram of krikium-treated Yolo loam into which 644 milligrams of nitrate nitrogen and 2,175 mg of potassium had been incorporated from a coated source.

PRACTICAL USES

Possible uses for materials with these properties are exciting, but application will be influenced by the cost of the coating process. Probably coated fertilizers will find application first for high-value plantings such as ornamentals and turfgrass. They show promise, along with other materials to be reported later in this series, of solving some difficult management problems in California's 100-million-dollar commercial flower and nursery industry.

The occasional rapid deterioration of vigorously growing canned nursery stock after it leaves the hands of the grower has been a problem. Liquid fertilization is now widely used by nursery stock producers in conjunction with highly permeable soil mixes, which have little retentive capacity for several of the fertilizer elements. Thus, while the grower may do an excellent job of producing stock, the retailer may not be equipped to maintain the stock properly, or the consumer may be disappointed with the rapid decline of a vigorous plant, caused by inadequate nutrient supply. Coated fertilizers are capable of minimizing or eliminating this problem.

HEAVY APPLICATIONS SAFE

Relatively large applications of coated fertilizers can be made safely, because the coating separates the fertilizer from the soil solution at the start. However, if the proper amount of deep leaching does not take place, salinity conditions can develop rapidly, as with other soluble fertilizers. Prolonged storage of moist soil containing coated fertilizer is not good practice, because the minerals released during storage may be excessive when a planting is finally made in the soil. In practice, one pound of actual nitrogen from a heavily coated source per cubic yard of soil has given excellent results with potted chrysanthemums and has grown them to maturity without further fertilization. (With granules $\frac{1}{8}$ to $\frac{3}{16}$ inch in diameter, the coating would represent 12 to 15 per cent of the total weight.)

Aside from the field of ornamentals, coated fertilizers will be of interest and probable value wherever leaching losses are high. Coupled with sprinkler irrigation, they may increase the utility of very sandy soils. At the proper rate and coating thickness, fertilizer can safely be placed directly with or beneath seeds to give a rapid plant response, which may be of particular importance where the growing season is short.

Foresters have sought a long-lasting fertilizer source which could be used at the time of planting seedlings. Looking at the broader soil resource in relation to population problems, the techniques of controlling and extending nutrient availability from fertilizer materials may be an important tool in more efficient utilization of soils in the tropical regions.

COVER PICTURE

"Lucky" Baldwin's Talley-Ho, with coachman and four, again travels the roads of the former rancho. A local sports emporium generously loaned the four hackney ponies, the driver in tails and top hat and the two footmen in pinks. It was a gay morning for the color photographers and soon we may have a new set of postcards for the Arboretum visitors. Photo: Denis Kucera

THE INTERNATIONAL CAMELLIA SOCIETY

PRESIDENT: Professor E. G. Waterhouse, O.B.E., Australia

VICE-PRESIDENT: Mr. A. Fendig, U.S.A.

DIRECTORS:

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Mr. K. Ishikawa, Japan
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Mr. R. N. Philbrick, U.S.A.
Mr. C. E. Puddle, United Kingdom
Mr. T. J. Savige, Australia
Mr. A. C. Soffe, Southern Rhodesia
Dr. W. Wight, India

The International Camellia Society will be inaugurated on April 1st, 1962. It will be the first international society to be devoted to a single genus of plants.

Due to the ease of modern communications, the interests of camellia enthusiasts throughout the world have become associated, and the promotion of an organisation to encourage research and friendship at an international level has become a necessity. The International Camellia Society has been inaugurated with the following motives:

To foster the love of camellias throughout the world and to maintain and increase their popularity.

To undertake historical, scientific and horticultural research in connection with camellias.

To co-operate with all national and regional camellia societies and with other horticultural societies.

To disseminate information concerning camellias by means of bulletins and other publications.

To encourage a friendly exchange between camellia enthusiasts of all nationalities.

The Society will always remain international in character for once established the Directors will be elected by members on a continental basis, thus ensuring equal representation for all camellia areas.

In an attempt to reflect the wishes of its members, the Society will always give careful consideration to constructive suggestions and criticism. Articles and illustrations for publication will be welcomed.

Membership is open to all, amateur and professional.

Annual Subscription: One Pound Sterling or equivalent in other currencies.

Life Membership: Twenty Pounds Sterling or equivalent in other currencies.

All communications and subscriptions to the Secretary: Charles Puddle, Bodnant Gardens, Tal-y-cafn, Colwyn Bay, Denbighshire, United Kingdom.

CALIFORNIA NATIONAL FUCHSIA SOCIETY

Seventh Annual Fuchsia and Shade Plant Show sponsored by the California National Fuchsia Society, will be held in the Municipal Auditorium at the foot of Long Beach Blvd., Long Beach, Calif. on Saturday and Sunday, June 16 and 17. The show will be open to the public from 2 to 10 p.m. Saturday and 12 to 9 p.m. Sunday. Admissions will be free to children under 12; ages 12 to 16 will be \$.50; and adults \$1.00.

Some thirty branches of the Society will enter garden displays competing for the Sweepstakes trophy, as well as other trophies and ribbons, using the show theme "Gardens to Remember". Other garden clubs will display companion shade plants and compete for trophies. Hybridizers will exhibit blossoms of seedlings which are possible future introductions, and blooms of their 1962 introductions. In a special educational booth the viewing public will have an opportunity to learn how to grow and take care of fuchsias and other plants. Many well-known garden consultants, lecturers and columnists will be on hand to help with gardening problems and answer questions.

A special feature, which will be one of the main highlights of the show, will be a blossom table displaying hundreds of varieties of fuchsia blooms, each variety properly named with a description of its growing habits. Commercial booths will be set up to inform the garden-minded public of what is available, and what is new to make their work easier and more effective.

Individual entries for competition are open to the public as well as to the members of the Fuchsia Society. Classifications for entries of fuchsia plants, fuchsia blooms, begonias, ferns, African violets, gloxinias, bromeliads, and related shade plants will be set up, also separate classifications are being provided for novices who have not won a ribbon or trophy in any show, and a class for experienced amateurs.

The Aesthetic and Recreational Values in Botanic Gardens

ELIZABETH ANN MOREL

PART 2

Part I of this article was published in Lasca Leaves, Vol. XII, No. 1 Winter 1962, pp. 12-18.

The Royal Botanic Garden, Calcutta. In Calcutta the Royal Botanic Garden came into existence for reasons quite different from the royal interest in botany which served to initiate the gardens at Kew. Older than Kew by about fifty years, the Calcutta Garden was founded, as were many other overseas botanic gardens during the later years of the eighteenth century, with economic and scientific aims. Today it occupies some 273 acres, an area somewhat smaller than the more than 300 acres it occupied in 1787.

The prospect of originating a botanical garden in Calcutta was first suggested to the Governor-General in June of 1786, by Colonel Robert Kyd of the Bengal Infantry.

Without delay, Kyd's proposal was accepted and the action taken to put it into effect. With the approval of the Court of Directors, the present site was acquired, located immediately below Colonel Kyd's private gardens. Appropriately, the colonel was appointed Honorary Superintendent and work was begun to develop the garden. The area became the property of the East India Company under the control of the Governor-General in Council, which is said to be the reason why the garden is referred to locally as the "Company Bagan." The word *Royal* came to be applied to it after the Queen's proclamation of 1858. Control of the garden passed to the local government in 1884, by the Constitution of the Province of Bengal. Colonel Kyd continued to serve as superintendent until his death, in 1793.

In 1864 the great cyclone of Calcutta occurred; it was accompanied by a tidal wave from the river Hooghly that laid the greater part of the garden under water, in some places to a depth of six or seven feet, and "carried two ships into the Garden with great

violence." Over a thousand trees, at least half of the total number in the garden, and innumerable shrubs were destroyed. Those that survived were "... much damaged ... scarcely a vestige of leaf, flower or fruit remained." Three years later a less severe but still very destructive cyclone, in which over 750 of the surviving trees were blown down, was said to have completed the ruin.

In 1871 Dr. George King took charge of the garden, which was by that time in a most unpromising state. The devastation wrought by the two cyclones had deprived it of all shade, a large expanse was under coarse grass, and large parts were still, as they had always been, little better than swamps. Most of the roads were narrow, subject to flooding and unfit for vehicular traffic, while the present ornamental lakes were represented mostly by unsightly channels and "tanks."

The entire grounds had to be raised in level, with the soil obtained from large areas which were made into ornamental sheets of water. These artificial lakes have been connected with each other by underground pipes and an electrical circulation pumping system, so that the water can be kept at a high level by means of water pumped up from the river. Many wide roads have been made all through the garden, so that "Carriages may be driven through every part of it."

The herbarium and the library have been developing gradually ever since the founding of the garden in 1786. The present building, designed to house nearly two and a half million sheets of authentic herbarium specimens which form the basis of all botanical and allied investigations, was erected in 1883. In this herbarium are found a very complete collection of the dried materials of plants of the whole of the Indian Empire, as are also fair collections of those from Asia outside of India, of Europe, and of Australia. Plants of Africa and of America are partly represented. For the systematic botanists, forest officers, herbalists, druggists, and the pharmacologists, the herbarium is perhaps the most interesting and valuable spot in Asia. Certainly it is the only place in India for botanical investigation of the kind it makes possible; it is recognized not only as the best herbarium in India, it is also recognized by the International Botanical Organization of the World as the best in the East.

Situated as it is on the west bank of the River Hooghly, only a few miles from the city, in respect to its location and its orientation it would appear to offer an interesting parallel to the Royal Botanic Garden of Kew, likewise situated on a great river, the Thames, and only a few miles from London. The gardens are of high scientific interest as well as of great aesthetic value; they serve as a source of inspiration, education, and research for the many visitors.

The Arnold Arboretum of Harvard University. Established in 1872 at Jamaica Plain, Massachusetts, the Arnold Arboretum has been actively introducing new woody plants into American gardens ever since. It is one of the largest trial grounds for hardy ornamental plants, upon which almost all the emphasis is placed. No strictly formal gardens are found here; instead, plantations are arranged informally. Studies are constantly being made as to new and better varieties of plants, and comparisons made with older types. Beautiful at all times, the appeal of the Arnold Arboretum is said to be irresistible.

This arboretum owes its origin to Mr. James Arnold, a merchant of New Bedford who died in 1868 and left to the trustees of his estate the sum of \$100,000 to be devoted to the advancement of agriculture or horticulture. One of these trustees was George B. Emerson, who realized the benefit which might be derived from the establishment of a scientifically managed collection of trees in Boston, and who proposed that Mr. Arnold's legacy be turned over to the President and Fellows of Harvard University and used for developing and maintaining an arboretum, with the further stipulation that they would devote to this purpose a part of the farm in West Roxbury which had been given to the University by Mr. Benjamin Bussey. This plan was implemented in 1872, and 125 acres

were set aside for the Arnold Arboretum.

The original agreement specified that the arboretum should contain "all the trees, shrubs, and herbaceous plants, either indigenous or exotic, which can be raised in the open air at the said West Roxbury." In time, however, the arboretum dropped herbaceous plants from its objective and concentrated on "trees, shrubs, and vines whose woody stems do not die down with the arrival of cold weather."

According to the terms of the Arnold bequest, two-thirds of the income from the endowment fund was to accumulate until the fund reached \$150,000. The new director, therefore, had no more than \$3,000 a year with which to develop a "scientific tree station" from property described as a "run-down farm, partly covered with a natural growth of native trees, nearly ruined by excessive pasture."

About this time, Frederick Law Olmsted, Sr., engaged in planning a park system for the city of Boston, suggested that the land might profitably be made a part of that system. The public, however, was apathetic to the suggestion, and both city and college authorities were openly antagonistic. Nevertheless, over a period of nearly ten years, the conviction and determination of Charles S. Sargent, arboretum director, and of Mr. Olmsted prevailed over the apathy and hostility. In December, 1882, a contract was made between the university and the city of Boston by which the city agreed to add certain adjoining lands to the arboretum, to construct and maintain under the direction of its park commission a system of carriage drives and walks planned by Mr. Olmsted, to police the grounds, and to assume all taxes which might be levied on the property during the thousand years for which the contract was made. In return for this aid, the university agreed to open the arboretum to the public from sunrise to sundown during every day of the year, reserving, however, entire control of all the collections, and of the grounds with the exception of the drives and walks.

When the city took title to the Arnold Arboretum lands, they forthwith leased the entire tract back to the President and Fellows of Harvard College for one thousand years, at a rental fee of one dollar a year. At the end of the period, the lease could be renewed by them for another thousand years, "and so on from time to time forever." Through this arrangement the arboretum has all the advantages of perpetual ownership of the land it occupies, and it is relieved of many of the burdens that weigh heavily upon the budgets of most similar institutions.

Work on the roads was begun by the city in 1885, but because of various delays in construction the planting of the principal collections of trees and shrubs was not undertaken until the year following. In 1894, seventy-five acres known as Peter's Hill, and part of the Bussey Farm, were added to the arboretum by the President and Fellows of the university; in 1898 the whole grounds were opened to the public with an encircling road built by the city's park department. Thus the contract with the city of Boston has been and promises to continue to be of great value to the Arnold Arboretum. In particular, it cannot be moved from its present location without the consent both of the university and of the city, and there seems little chance that the people of Boston will ever consent to give up a public park of such unusual character and beauty, however valuable the land may become.

Forming one of the series of Boston parks with which it is connected by a broad parkway, the Arnold Arboretum now occupies 260 acres of meadow, hill, and valley. It is close to the Forest Hills station of the New York, New Haven and Hartford Railroad, and it can be reached by two electrical railway lines. Its natural features include a broad meadow along the northeastern boundary, and three high hills separated by narrow valleys through one of which flows a small stream. One of these hills is covered by a remarkable growth of hemlock trees, natural woods said to be the great natural feature

of the arboretum. With its high, steep cliffs rising on the north from the Bussey Brook, this portion of land is covered so thickly with hemlock trees that the rays of the sun seldom penetrate to the ground between them. In no other public garden are there to be found such cliffs or a more beautiful remnant of a coniferous forest. Oaks and other native deciduous trees a hundred years old or more still cover small areas on each side of the Meadow Road, on Centre Street, and on Bussey Street at the eastern base of Peter's Hill; these are valuable in showing several eastern New England trees in their mature form.

The climate is a restricting element, since frost and very severe winters occur, but the plantings are valuable in showing the variety of material which can withstand the damaging effects of freezing. The regions represented by the living collections are the cool temperate and colder parts of North America, Europe, and Asia, including the higher altitudes of the Himalayas and other more southern mountains. No plants from the southern hemisphere, not even from the high Andes, southern Chile, or the higher mountains of New Zealand have proved hardy in the arboretum.

The purpose of the Arnold Arboretum has been and is to add to the knowledge of trees and other woody plants. To accomplish this, something more than the collection of living plants hardy in the eastern part of Massachusetts, as contemplated by the trustees of James Arnold's will, has been necessary. Hence the Arnold Arboretum as now organized includes, first, an out-of-doors museum, in which the public may see the trees and shrubs of the north temperate zone conveniently arranged; second, a dendrological station and laboratory in which the scientific study of trees is carried on; and third, a bureau of publication, exploration and exchange by means of which botanical exploration in different parts of the world may be undertaken, and the results of these explorations made known and distributed.

Harvard Botanic Station for Tropical Research. During a conference held in 1900 at Central Soledad, attended by Edwin F. Atkins, Professor Oakes Ames, and Professor George L. Goodale of Harvard, it was agreed that the Harvard Botanic Station for Tropical Research should be established on the Atkins Sugar Estate at Soledad, Cienfuegos, Cuba. The garden was formally inaugurated in 1901 on Colonia Limones, about one-half mile from the present Harvard Biological Laboratory. The site selected was picturesque, of a hilly or undulating character, with a brook winding through the central ravine; the soil was varied in composition but was chiefly of a shallow, reddish, clayey nature, with a porous and more or less decomposed limestone subsoil. The landscape was rather barren, devoid of trees. At the outset this situation was detrimental to plants and shrubs requiring shade, but severe damage was prevented by erection of a shade house, which afforded protection from the direct sun and heat for the important species until some of the rapidly growing trees provided for the necessary shade.

A small greenhouse erected in 1902 proved of the greatest importance for the germination of tropical seeds and propagation of tender cuttings and for small plants requiring extra heat and moisture during the drying winds and cool winter weather.

During the first few years, operations were devoted to a great extent to sugar-cane interest. In the autumn of 1901, a choice collection of plants, including palms, orchids, and many ornamental species, was presented to the garden as a gift of Professor Oakes Ames, from his conservatories at North Boston, Massachusetts. A number of seeds and plants were presented by the Harvard Botanic Gardens at Cambridge. These plants are said to represent a notable part of the ornamental specimens growing in the section known as the "Old Garden." By December of 1903, the garden contained some 243 genera and 400 species of plants, shrubs, and trees, with donations of plant materials being received at intervals from various parts of the world. In January, 1905, a water supply and pumping system was installed and proved to be of great assistance. Previ-

ously, the irrigation had been from the garden stream, carried by hand; needless to say, this was less than adequate for the rapidly increasing plant collection. A second greenhouse was constructed in February, 1907, to provide for the increasing work on cane-hybridizing and the growing demand for propagating space. In 1908, flowering and ornamental garden subjects were taken up for special experimental studies. Sixty plots were devoted to northern annuals, herbaceous perennials, flowering and ornamental bedding plants, bulbous stock, and roses.

In June, 1911, a destructive cyclone swept the garden, and although it lasted but forty-five minutes, the trees were denuded of branches and foliage or blown down, palms were wrenched off at the neck, the collection of bananas and hybrid canes was badly broken down or torn from the ground, and many citrus trees were injured or uprooted. The greenhouses and Colonia buildings were completely demolished. Further, the precipitation of two inches of rain in forty minutes which accompanied the cyclone changed the garden stream into a torrent which carried many plants along with it. The number loss of specimens was severe; seventy species were totally destroyed. However, the injured stock was replanted at once, and in part because of the very favorable weather which followed, recovery was rapid.

During the following years new species were constantly being added, and so rapidly that specimens were becoming overcrowded. As a result, it became necessary eventually to increase the garden area. This was made possible in the winter of 1919, through the generosity of Mr. Atkins. The new area proved to be of special value in extending the scope of the "new arboretum," devoted to the cultivation of native hard woods and timber trees, a department promoted by Dr. Thomas Barbour. In 1925 a dam was constructed in this new section of the garden, partly to augment the water supply during seasons of severe drought, and partly also to permit the cultivation of aquatic plants. However, the frequent heavy summer floods destroyed many varieties of pond lilies; so these are now grown in tubs and in controlled sections of water, for protection.

At the Harvard Botanical Station during the winter season, the climate is said to be ideal: rains are infrequent and the days are bright and cheerful. Occasionally the sun is too hot for a few hours at midday, but even at these hours the cooling northerly winds are prevalent. The nights are always cool and characterized by air movement. Frost is rare during the winter months, but it has been recorded since the establishment of the gardens. The rainy season usually begins about the middle of May and ends the last of October, with the heaviest precipitations commonly occurring in June, September, and October. In July and August, sharp electric storms are not unusual, but the rainfall then is frequently only a matter of light showers. Unfortunately, a large area of the garden land is shallow, with rock or decomposed subsoil which dries out rapidly. Thus care is required when plantings are made to select species most suitable for the drier areas, so that artificial watering may be avoided so far as possible and practical.

Chief functions and purposes of the Harvard Botanical Gardens, Soledad Estate, are these: to acquaint students of botany with tropical flora, and to provide for experimentation with economic crops. One of few such gardens in tropical America, it is the only one not government supported. Its 221 acres are encircled by the Soledad Sugar Company, a sugar plantation owned and operated by the Atkins family, original donors of land for these gardens.

Fairchild Tropical Garden. The garden is described as a fascinating expanse of lakes and islands, with its palms, its grassy walks, and its vine-covered walls. The Palm Glade, one of its important features, would seem to be altogether delightful.

Colonel Robert H. Montgomery, a member of the Board of Managers of the New York Botanical Garden and one of the official Committee of Visitors to the Arnold Arboretum, realized the need for a botanical garden where everyone could come freely

to see and enjoy the beauties of tropical plant life, without the need to ask permission to enter a private estate. Accordingly, he donated and developed twenty-five acres of land in southern Florida for this purpose. At that time he expressed the hope that the garden would become "an institution from which information regarding, and examples of, new plant material could benefit not only our own country, but perhaps the world." To insure the permanence of the garden beyond the lifetime of the donor and originator, Colonel Montgomery specified that the garden should thereafter belong to and be supported by the public.

Through the dedicated interest and enthusiasm of persons interested in this cause, the Palmetum was informally organized in 1934. Since then, it has become one of the most important collections of palms in the entire world, a mecca for all those interested in this useful and ornamental plant group. In 1938 an additional fifty-eight acres of land to be used in conjunction with and for similar purposes was donated by David Fairchild. In the original statement of conditions are these words, that "this land must be developed, used, and maintained exclusively as a botanical garden or arboretum, featuring tropical trees and plants."

When the Fairchild Garden became the property of Dade County, the acreage could be included in the general Civilian Conservation Corp program which was centered on the Matheson Hammack area adjoining the donated land. By this means, over a period of about three years, preparation of the grounds on the county side was accomplished. The National Park Service, through the CCC, furnished all necessary construction, engineering services, and supervision.

The natural terrain of the combined Montgomery and Fairchild tracts is relatively flat, with existing native semi-tropic vegetation. The climate of the favored locations at the Fairchild Garden is the most tropical of any in the entire United States. Although nearly every part of the site is at some time subject to light frost, this may also be said of many regions where strictly tropical plants are grown. The rainy season occurs in summer, the dry season in winter, much like tropical places north of the Equator. Periods of drouth occur, of some severity, but water for irrigation is always available; there is a network of underground streams of fresh water under much of the land. This can be tapped by shallow, driven wells. Annual rainfall is high, attaining some seventy-six inches in rainy years. The night temperature is not too cool, even in winter, for the growth of many tropical plants.

Variety in soils is not so great as could be desired, and in general the soil may be thought to have too large a lime content. In the areas favored by the mildest climate, the soils are said to be rocky or composed of marl. Because of the extreme porosity of the substrata, an advantage may be found in the almost complete absence of mud. Three general classifications of soil types are found in the garden, however—highland, hammock land (forest), and lowland. Hence it is said that this site is ideally located for a collection of tropical plants, and that the maximum number of tropical trees and plants may be expected to flourish here in the Fairchild Tropical Garden.

The decisions as to objectives of the garden and the drawing up of its plan were undertaken by William Lyman Phillips, a well known tropical landscape architect, in consultation with Mr. Noel Chamberlain, considered outstanding in site planning. The entire eighty-three acres were surveyed, the principal features were determined, the future buildings located, and the roads and lakes mapped out. The problems and limitations were thoroughly studied by these trained men, and the decisions were made that this garden should provide for the study and display of truly tropical flora, except for the native material already available at the adjoining Matheson Park.

In Mr. Phillips' preliminary study of the project, he has stated the various reasons for a botanical garden of this type:

1. To make an exposition of systematic plant relationships.

2. To exhibit conveniently the flora of a region, with or without ecological relationships.
3. To exhibit new species having economic or ornamental value, such as is done by a plant introduction garden.
4. To demonstrate the garden or park-making values of familiar or unfamiliar plants.
5. To display with the greatest possible completeness certain groups of plants.
6. To make a collection of oddities and rarities, without much regard for their scientific significance or usefulness.

SUMMARY OF REASONS FOR BOTANIC GARDEN DEVELOPMENT

The Royal Botanic Garden of Kew owes its origin to certain royal interests in botany and in the collection of plant species. The great garden at Calcutta, however, founded only a half-century earlier, owes its establishment to economic and scientific aims. Colonel Kyd's suggestion will be recalled, that the garden should provide "a stock for disseminating such articles as may prove beneficial to the inhabitants of Great Britain . . . which may ultimately tend to the extension of the national commerce."

The Harvard Botanic Station for Tropical Research was developed for reasons which its very name suggests; its stated chief functions are to acquaint students of botany with tropical flora and to provide for experimentation with economic crops. To a large extent its operations have been devoted to interest in and study of the economic value of sugar cane. Its actual establishment was due to the financial assistance of E. F. Atkins, Esq., and to the combined persuasion, encouragement, and organizational aid given by Professor Oakes Ames and Professor G. L. Goodale of the Arnold Arboretum, among others.

In contrast to all these reasons for development are those of the Fairchild Tropical Garden. Here the gardens have come about because of the land donations of two individuals who realized the need for a botanical garden where the public might come freely to see and enjoy the beauties of tropical plant life. They hoped that the gardens would develop into "an institution from which information regarding, and examples of, new plant material could benefit not only our own country but perhaps the world. Thus the primary purpose has been to increase the interest of all people in plants of tropical interest and beauty, "an overall dominant aesthetic motivation."

The Arnold Arboretum owes its origin to a gift of \$100,000 "for the advancement of agriculture or horticulture." The benefit to be derived from the "establishment of a scientifically managed collection of trees," which would survive in the climate of Boston, was recognized by those charged with the use of the gift, and so they sought to increase through this garden the knowledge of trees and other woody plants. Hence they established an "out-of-doors museum . . . a dendrological station and laboratory . . . and a bureau of publication, exploration and exchange . . ."

There are definite major factors which repeatedly can be seen to have influenced the development and operation of botanic gardens throughout recorded history. Botanical collections were amassed for the pleasure of royalty more than three thousand years ago. Plant explorers were sent out to locate and bring back exotic and interesting plants of many kinds, to add to the collections of their sovereign.

A second phase in the pattern of origin and development may be seen in the collecting of plants for their medicinal and curative properties. Such collections were among the first to be used for educational and teaching purposes. The early universities recognized the value of the botanic garden as a means of supplying the necessary material for the study of medicine and of botany. The collections became larger, more varied in content; they grew in number and in scope.

"The state" was the next influence to assume initiative and control, to assist in the development of botanic gardens, usually because of the need for financial or administrative support and assistance. Generally speaking, gardens with such endorsement were

the first to emphasize or give any importance to arrangement of the plants for the enjoyment and pleasure of the general public. Up to this time gardens had been provided for the singular use of plant scientists, physicians, botanists, and royalty. An added factor in state-supported gardens was the interest in propagation and use of plants for their economic values, particularly in regard to their importance in various colonial developments.

Botanic gardens which have come into existence in fairly recent years have originated, in many cases, because of a gift of land or of funds from an interested or philanthropic citizen who desired to augment the interest of all people in the beauty and culture of plants.

In the botanic gardens of today, all of the foregoing developmental factors can be seen to have played their part in some way. Those which at one time were of primary importance, singly, now function in combination, with varying emphases: the recreational and pleasure, the scientific, the educational, the aesthetic.

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(To be Continued)



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Preservation of Foliage Materials for Permanent Arrangements

BOBBY M. VARGAS

The search for and the use of new and different plant materials in flower arrangements never seems to end. This includes ways in which to preserve certain foliage subjects so that they may last a long time or be used over and over again. There is such a process which preserves certain types of plant materials, and this process has been used quite successfully at Descanso Gardens in La Canada, California.

The basic chemicals for this process are glycerine and water. Experiments, using various concentrations, have proven that the best mixture is one part glycerine to two parts water. Glycerine should be added to warm water when mixing.

The weather makes a difference in the time required to treat foliage; dry, warm weather hastens the process, because plants transpire more readily during such time. The greater the transpiration rate, the more material absorbed, the quicker the treatment.

Mature branches with mature leaves should be used for preservation of foliage.

METHOD OF TREATING THE MATERIAL

Branches must be picked in the cool of the day; early morning or late afternoon, or when they contain the greatest percent of moisture. Always make sure that the plant is at its peak freshness.

It is wise to start with a branch large enough to allow for trimming or cutting later. Remove all broken, crushed or insect eaten leaves and any other parts not wanted in the finished product.

One of the best methods for accelerating absorption is to crush two or more inches of the base of the stem. This furnishes a larger surface through which the plant may absorb the solution. As soon as possible after crushing, submerge the plant stems in the glycerine-water solution.

A word about solution containers. Narrow containers keep the solution level at the proper height and have the advantage of requiring less solution. It is not necessary to use glass containers, because the material of the container appears not to affect the treatment.

Next, place the container and plant out of drafts and sun. Keep the plant in the solution until the leaves begin to change color. During this process, you can observe the solution traveling up the stems and into the veins of the leaves. The branches may be removed from the solution any time after the solution has traveled past the leaf joint of the upper most leaf. The smaller the amount of solution in the branches, the dryer the treated branches, resulting in brittleness. The more solution the branch absorbs, the more pliable the branch will be.

The method of treating with less solution will result in effective mottled patterns; in many cases giving some very interesting results. For other unusual effects, the use of food color or other vegetable oil stain mixed with the solution will impart interesting shades.

Special attention should be given to Eucalyptus, one of the most versatile plants to use for preservation. First, treat the branch in the usual manner, crushing stem, etc. Then extend the absorption time until you see the solution bubbling out of the stem. This is an indication that the branch has absorbed all it can, and is now beginning to transpire the excess solution. Now expose the branch to full, hot sun for two or three days. You will observe that the sun will bake a very beautiful reddish brown color into the leaves of the branch. The main stems of the branch will be almost ebony-black. Wiping the leaves with a soft, dry cloth will give them a very high luster.

One point should be considered in treating slow growing plant materials. Their treatment time may be quite lengthy. An example of this kind of material is *Magnolia grandiflora*, which may take as much as six weeks to obtain the desired results. In order to obtain a very dark brown, or almost black leaf it is often necessary to make a fresh cut and a fresh crush at the base of the stem after a week of treatment. Often, when using *Magnolia* the absorption rate will seem to slow down. This results in dry edges on the leaves. The leaves can be dabbed with the glycerine solution to prevent such drying. The solution is absorbed through the leaves.

Foliage such as peach, apricot, pear and other soft leaves will hang limp after absorbing too much glycerine solution. There is a lot of experimenting still to be done in processing these types of leaves. Most leathery type leaves absorb the solution well. Fleshy or succulent leaves do not hold up.

Some of the trees and plants that will treat well are: *Magonlia grandiflora*, most eucalyptus, oaks (evergreen and deciduous), native and European sycamores, bays, loquat, acacias (both in and out of bloom), the *Prunus* family which includes the peach and apricot; oleander, camellias, Australian tea in bloom, heather in bloom, guava and pittosporum. Some weeds are treated to advantage, such as dock.

Materials preserved by the described process will last from six months to two years depending upon the type of leaf and the glycerine saturation of the foliage.

Information Aid

Descanso Gardens

Salt Affected Soils

DONALD EBERHARD

Many soils in the Western United States contain sufficient salts to restrict or prevent plant growth. This problem is common in areas of low rainfall and, unless it is understood and prevented, extensive damage may occur.

TYPE OF SALTS

Salts most commonly found in soils consist primarily of sodium, chloride, nitrate and sulfate; secondarily of potassium, bicarbonate, carbonate, nitrate and boron, which may take the form of sodium chloride (table salt), magnesium sulfate (Epson salts), calcium sulfate (gypsum) and other combinations.

SOURCE OF SALTS

The primary source of all salts is the earth's crust. Decomposition of rocks by weathering processes releases salts in a soluble form. In high rainfall areas, the salts are normally leached through the soil into the ground water and eventually to the ocean. In arid regions, where rainfall is not sufficient to leach all of the salt out of the soil, salts collect in low areas or are washed into streams or rivers. This water, with its load of salts, may be used again and again downstream for irrigation, such as with the Colorado River. The accumulation of salts to a harmful degree may be caused by certain irrigation practices.

The water table may rise to a point where water is evaporating from the surface. As the water evaporates, salts are deposited on the surface or left as a residue in the soil. The other and more common source of salts is due to surface application of water which is high in soluble salts. All irrigation waters contain varying amounts of salts of various types. It is very important to know the amount and kind of salts in your irrigation waters, because waters of different quality are handled differently.

When the water enters the soil several things may happen. If enough is applied it may percolate through the soil and take the salts with it. More often, the water is used by plants or evaporates from the surface and many of the salts are left as residue. As this keeps occurring, the salt content builds up and may reach a level where the plants will be damaged. Certain fertilizing practices may build up the salt content in the soil. Continued use of steer manure with insufficient leaching will cause a salt build-up in the soil. Restricted drainage may cause a build-up of salts by preventing the salts from being leached out of the soil.

EFFECTS ON PLANTS

Salt affects plants in two ways. The accumulation of salts in the root zone results in an increase in the osmotic pressure in the soil solution and, in consequence, the rate of entry of water into the plant roots is decreased. (This happens even though the soil has plenty of water in it, but the salts make it unavailable to the plants.) The second effect on plants is a specific toxicity effect. The chemicals which are most frequently toxic when accumulated in excess amounts in the plants are: chloride, sulfate, bicarbonate, sodium, calcium, magnesium and boron. A characteristic leaf burn develops (such as marginal necrosis) and the leaves drop off when salt toxicity is the problem.

EFFECTS ON SOILS

Saline soils contain an excess amount of salt with a relatively low sodium content. Normally, saline soils have a good physical structure and the main effect is the reduced water uptake by the plants. This type of salt is sometimes detected by a white crust on the soil surface.

Alkali, or sodic, soils contain an excess of sodium salts which give rise to poor physical conditions in the soil. Poor water permeability, decreased aeration and difficult tillage are characteristics of a sodic soil. These soils often exhibit black surface deposits which led to the term "black alkali."

Soils that contain both too much salt and too much sodium are called saline-sodic soils and have the worst features of both types.

IMPROVING SALT AFFECTED SOILS

Leaching of water through the soil is the only method of solving the salt problem. There are no chemicals that will neutralize salts.

Saline soils are relatively easy to leach if there is good drainage. Often poor drainage has caused the saline condition and in this case, drainage must be provided before leaching can be accomplished. If poor quality water is all that is available for leaching, it is important that the salt level in the soil be brought down to the lowest possible level. Also, that frequent leachings be applied at regular intervals following reclamation.

Sodic and saline-sodic soils need a soil amendment to successfully accomplish reclamation. Before leaching it is necessary to add gypsum, sulfur or some other amendment that will cause displacement of the sodium. The amount of amendment necessary can best be determined by a soil analysis. The amount of water needed depends on the amount of salt present and the quality of the water. Six inches of water moving through the soil leaches about fifty percent of the salt out of the top foot. To get a complete reclamation it normally takes at least two feet of water passing through the soil.

SALT TOLERANT PLANTS

Plants vary in their tolerance to salts. When a condition exists that prevents complete leaching of the salts or a poor quality of water is the only choice, salt tolerant plants must be used, if the salt level is within their range of tolerance. Lists of salt tolerant plants are available. Included are: palms, eucalyptus, olives, many shrubs and several ground covers including bermuda grass.

PREVENTING SALT BUILD-UP

Prevention of salt accumulation is much simpler than trying to correct it. Proper watering procedures are the best insurance against salt build-up. Good drainage is also important and should be checked first and developed if necessary. Proper watering includes enough water at regular intervals so that part of the irrigation water goes through the soil and carries away any excess salt. Light, frequent irrigations increase the danger of salt accumulation, while infrequent, heavy watering prevents salt build-up.

SUMMARY

Salts are found everywhere but they are normally only a problem in the arid West. The main source of salts coming into a soil is through the water. The only way to get rid of salts is to leach with water. An excess of sodium salts in the soil deteriorates the physical condition of the soil; amendments are needed in conjunction with leaching to complete reclamation. The best way to find the amount and types of salt in the soil is by having the soil analysed by a laboratory experienced in salted soils.

Paulownia Tomentosa

ROSS GOODRICH

Almost any list of interesting deciduous trees would include the Empress tree of China, *Paulownia tomentosa*. A good specimen of this tree can be seen on a tram ride through the Los Angeles State and County Arboretum. Along the middle of the Asian Section, where the curve of the road seems to take you right into the plantings, this tree stands just a short way up the bank.

P. tomentosa, tall and pyramidal shaped, is noticeable at any time of year in each of its three annual phases: winter bareness, spring bloom, summer leaves. In winter, the leafless branches hold on to the empty seed pods from last year's bloom and display the velvety, brown buds for the next. An unspeakable combination to the tidy minded, this winter beauty was one of the reasons for its cultivation in China from an early date. At the Arboretum, the blossoms have usually opened during the gloomy early spring. Lavender and foxglove-like, they are hard to see against the grey sky, but show up brightly, like a jacaranda, in front of other trees. Their fallen blossoms are attractive on the lawn and their gentle lemon scent doesn't drive one from the area. The blooming period has been short. The leaves come on fast to make the tree look like a catalpa. Its summer shade is dense and cooling and the leaves hang on until October.

Beautiful? Yes.

Messy? To most people, yes, because of the big leaves dropping in the fall and the blossoms in the spring. Compare it to the jacaranda? No.

This Paulownia is a distinctive tree. Its present height of fifty feet is usual for this species and was reached in about ten years. Its pleasant seasonal changes add much interest to our oriental collection.

Arboretum Gardener
Asiatic-Pacific Section



Paulownia tomentosa, growing in Asian Section of Arboretum. This specimen approximately 50 feet tall. Photo: Denis Kucera.

COVER PICTURE

Mary Anne Dowds, a student in this summer's Arboretum Children's Education class 'Art in Nature', made the seed mosaic. This was one of three lesson-projects completed during the six class sessions. Her teacher, Miss Sue Maloney used the mosaic idea to teach children to recognize simple and compound leaves.

Can you identify: corn, red kidney beans, peas, brown and white rice, lentels, lima beans, barley, red beans and tapioca?

Photo: Denis Kucera

Camellias of Today and of Tomorrow

REG RAGLAND

Presented before the San Diego Camellia Society, May, 1962

Why do we fanciers and hobbyists believe that the camellia is supreme among flowers? In my case it is, first, the sheer beauty of the flower, blooming as it does, in the winter when there are so few other out-door flowers. And then I am fascinated by the camellia's versatility—its great diversity in form, in size and in color.

True, it seems to have only two basic colors, white and red. But Nature has made the most of those two, producing clear reds and pinks, but also soft tones of both, and in between, and infinite number of shades and tones—in some cases, adding generous amounts of sparkle, or sheen, or iridescence.

In the variegated flowers it has mixed these same shades of red and pink with white, and achieved marvelous, often spectacular, results in design, and in distribution and clarity of markings.

As for size, the camellia can suit every taste. There are beautiful small flowers, down to 1" in diameter or less; and there are beautiful large flowers, some over 6" in diameter and over 3 inches high. In between the larger flowers and the miniatures are all gradations of dimension; some sizes suitable for corsages for the ladies and for boutonnieres for men; some sizes effective for hair dress; many different sizes excellent for flower arrangements; and all sizes wonderful for table decoration and for beautifying the home generally.

As marvelous as the camellia of today is, it cannot be denied that it lacks two qualities which lovers of flowers generally believe are desirable. First, if yellow can be bred into our popular species of camellia as a basic color, we can develop many interesting and beautiful color combinations that we do not now have. Secondly, we have all noticed that when strangers to camellias first see one, and pick it up, they almost invariably hold it to the nose as they would a rose, and almost invariably also they have the same reaction—a look of disappointment.

There is a legend that the camellia once had fragrance but lost it. Doug Thompson of the Pacific Camellia Society makes a most interesting talk on the history and legendry of camellias; and in it he has this to say on the subject. I had better read it and quote him exactly when I repeat gossip I should at least be accurate:

"In curious poetic allegory, borrowing from Roman mythology, Roberto di Grand many years ago wrote of the lost fragrance of the camellia. He told of Venus, goddess of bloom and beauty, protectress of gardens, surprised by Vulcan in dalliance with Mars, and of Cupid reprimanding his mother on her unseemly conduct. Venus, in retaliation, ordered Cupid whipped with the stems of roses. Flora, goddess of flowers, moved by pity for Cupid, dispatched the West wind, Zephyr, to Japan to bring the stems of the thornless rose, known to the gods as Anacanthus—to men as Susanqua—and the whipping of Cupid was carried out in painless formality. Then Venus hated the camellia, took away its fragrance and ordered its banishment out of sight and mind behind the impenetrable monsoon curtain of southeastern Asia."

I do not believe this gossip. I think that both of the deficiencies in the camellia to which I have referred—lack of fragrance and lack of yellow as a basic color—are due entirely to neglect, and that both can be remedied. That may seem to be a very presumptuous statement when one considers that the camellia is centuries and centuries old.

One of the foremost authorities on the camellia is the British botanist, J. Robert Sealy. In his monumental work, "A Revision of the Genus Camellia," published in 1958 under the auspices of the Royal Horticultural Society in London, he tells us that four species of camellia—*japonica*, *sasanqua*, *reticulata* and *saluenensis*, have long been esteemed as decorative plants in their native lands of Southeastern Asia; that from time immemorial the *japonica* has been grown in temple gardens throughout China; and that its use as an ornamental plant was probably first initiated at a very early date by Buddhist monks. We have 20 varieties of the *reticulata* in this country. Sealy says that 72 varieties of *reticulatas* were listed in a Chinese book about camellias written in the 11th Century A.D. (and that this would indicate that even at that early date, the *reticulata* had been in cultivation for a long time.

But it was not as an ornamental plant that the camellia first became known to the world outside its native lands. Rather, it was as a plant from which there could be produced a beverage that soon came to be regarded as an almost indispensable asset of modern life. As you know, the camellia species *sinensis* is the tea plant. According to Chinese legend the discovery of the use of tea, as a beverage, was made about 2700 years B.C., but Sealy says that it is really impossible to say how long the tea plant has been utilized by Mankind.

One variety, widely distributed through the warmer parts of southern Asia, has long been used by the native peoples, not as a beverage, but as an article of food. The food is known as "leppett" in Burma and as "Mieng" in Siam and Indo-China, and is made by boiling or steaming the leaves and then packing them in a hole in the ground for some time under pressure. The resulting "pickle" forms a traditional article of food of the Burmese, while in Siam and Indo-China it is commonly used by the Laotians for chewing. Perhaps the Laotians have plugs of "chewing tea" analogues to the plugs of "chewing tobacco" once popular in this country, supposedly as a stimulant. I dare say that "chewing tea" is just as stimulating as "chewing tobacco"; and I am sure that it must be more pleasant.

Perhaps some of you may not know that camellia *seeds* also are regarded as valuable for commerce in Japan and China. They contain a high percentage of oil which is extracted on a commercial scale from certain species. In Japan, the *japonica* and *sasanqua* are the principal species from which oil is obtained. In that country the oil is used principally as a hair-dressing. In China the seeds of the species *oleifera* yield an excellent oil known as "tea oil" which has a wider use and is of great economic importance in China and in Indo-China. There it is used not only for toiletries such as soap and hair-dressing, but also as a light lubricating oil for small machinery. Sealy says that in South China it was also used for cooking.

It is uncertain when the camellia first reached the western world. There are three camellia trees 18" to 24" in diameter at the base and nearly 30 feet tall standing in the garden of a villa in Portugal, which according to the family archives of the owner of the villa, were brought from Japan as young plants and were set out in the garden in the middle of the 16th Century. Until the existence of these trees was publicized in 1959 it had generally been thought that camellias had their first European introduction as orna-

mental plants in England around 1739. It is known that many attempts were made to introduce *camellia sinensis*, the tea plant, into Europe in the early years of the 18th Century and it is possible that *camellia japonica* was supplied in mistake for it. Doug Thompson suggests that the sea captains plying the trade routes to the Far East, not content to bring just the tea to Europe, greedily sought to obtain the tea plant itself—the goose that was laying the golden egg, but were cheated by the wily, monopoly-minded Chinese merchants who substituted *japonicas* for the tea plants. In any event, it was not until 1792 when a captain of one of the ships of the British East India Company brought two *japonica* varieties, "*Alba Plena*" and "*Variegata*," to England, that camellia culture really started. These varieties were soon followed by others including "*Lady Hume's Blush*" which was taken to England in 1806. In a very short time camellias became popular conservatory plants.

Indeed, the first half of the 19th Century was the golden era for the camellia in Europe. Nurserymen in England, France, Italy, Portugal and Belgium developed many new varieties of the *japonica*. It was during that time that Alexander Dumas wrote his tragic story "*La Dame aux Camellias*" which became the play "*Camille*" and the opera "*La Traviata*." Nearly a century later it was made into a movie with Greta Garbo as the star. Dumas's "*Lady of the Camellia*" was, in real life, his innamorata, Marie Duplessis. The flower was associated with her throughout her life, and even after her death. In a glass box set in marble at her grave there was displayed an artificial wreath of white camellias. Not only has *Camille* lived in song and story for over a hundred years, but she has influenced the pronunciation of the flower to this day. Scholars and botanists pronounce it with a soft 'e'—ca-mell-ya, after the Jesuit missionary in whose honor the genus was named, George Joseph Kamel, whose Latinized name was *Camellus*. But like many others I pronounce it ca-meel-ya, after the lady of the Dumas novel.

As in her case, and within the span of one human life, tragedy also befell the camellia. It had a merry hey-day in Europe, but a short one. By 1860 there had been a complete reversal in popular taste in flowers, and the camellia was being replaced by roses, carnations and gardenias so that by the end of the 19th Century the camellia had almost disappeared in Europe.

It had a somewhat similar history in America. There were attempts about the middle of the 18th Century to introduce and cultivate the tea plant in Georgia and South Carolina but all these attempts failed; undoubtedly because the tea plant, much more than the *japonica*, requires a very temperate climate. Early in the 19th Century the *camellia japonica* was introduced in the New York and Philadelphia areas where it became popular as a greenhouse plant, and in South Carolina where it was planted out of doors—among other places in the famous Middleton Gardens and Magnolia Gardens which were started at about that time. Camellias soon spread throughout the South Atlantic and Gulf States and enjoyed great popularity until the Civil War. Apparently they were victims of that war and of the era that followed. During the last fifty years there has been a renaissance of the camellia in the South but one cannot be sure that this will last because too often in recent years our Southern friends have lost their out-door flowers because of cold damage to the buds. Unless something is done about it, popularity of the camellia in the South may again wane.

On the other hand, if camellias were slightly more cold resistant, not only would they be more secure in the South, but the northern limits of the area in which they could be grown out-of-doors on the Atlantic seaboard would not be around Norfolk, Virginia,

as it is now, but would extend through Philadelphia and New York to New England, and a vast market for camellias would exist not only for the flowers but for the hardy evergreen plants so useful and valuable for landscape purposes. On that basis, nursery-men and commercial interests would long ago have done, or supported, scientific work to induce qualities in both plant and flower considered desirable.

As it is, except for the work in recent years of Howard Asper and of a few amateur horticulturists, we owe practically all of our wonderful camellia varieties to the bees. Looking only for food, they have done most of the cross pollinating. With no interest whatever in creating new varieties, they have produced some marvelous results. But, of course, they can operate only within their own cruising range. This is too limited for them to combine the genes or "building blocks" of a species of camellia having substantial fragrance or those of the species capable of producing yellow flowers with those of the *japonica*. That, of course, will always remain true so far as the bees are concerned.

Man must intervene to a much greater extent, and he is now in a position to do so. Thanks to modern miracles of jet transportation and plastic packaging, he can have available for his hybridizing efforts, material from varieties or species or genera from any part of the world not politically closed in. But someone must take the initiative; and the work, to be most effective, should be done on a scientific basis.

In recognition of this fact, a small group of men, most of them scientists, have banded together as the "Camellia Research Advisory Committee" and have dedicated themselves to the breeding of new and better camellias through scientific methods after, and resulting from, scientific studies. Its over-all objective is to promote and perpetuate interest in the camellia and to see that its popularity never again lapses.

The accomplishment of this objective will require the dedication of which I speak, but it will also require knowledge—a lot of it. This is so important that I am going to take the time to give you the names of the Research Committee. Some of them you know personally or by reputation. As to the others, you can get some idea of their calibre from the positions they now hold or have held in the past.

In the field of Botany, the Committee has as members:

Dr. Wm. S. Stewart, Director of the Los Angeles County Department of Arboreta and Botanic Gardens; Dr. Harlan Lewis, Chairman of the Department of Botany at the University of California, Los Angeles; and Dr. A. G. Plakidas, Professor of Botany (Retired), Louisiana State University.

Two very eminent geneticists and plant breeders are members of the Committee:

Dr. Walter E. Lammerts, Director of Research, Germain Seed Company, Livermore, California; and Dr. David Armstrong, Director of Research, Armstrong Nurseries, Inc., Ontario.

The Committee has two outstanding cyto-geneticists:

Dr. Albert E. Longley, Retired from the Agricultural Research Service of the United States Department of Agriculture, and now associated with the Rockefeller Foundation; and Dr. Samuel L. Emsweller, Leader of the Ornamentals Branch of the Agricultural Research Service of the United States Department of Agriculture at Beltsville, Maryland.

In Biology we have a most distinguished scientist:

Dr. James Bonner, Professor of Biology at the California Institute of Technology in Pasadena.

Several well-known horticulturists round out the scientific group on the Committee: J. Howard Asper, Superintendent of the Huntington Botanical Gardens; Dr. Francis de Vos, Assistant Director of the U. S. National Arboretum at Washington, D.C.; and Frederic Heutte, Director of the Norfolk Botanical Gardens in Norfolk, Virginia.

Carl Tourje is Chairman of the Committee. He retired from the practice of law in Chicago many years ago and has become, I dare say, one of the greatest students of the camellia in this country—certainly one of the most dedicated. As you know, he was the editor of the book "Camellia Culture" published a few years ago. Although an amateur, he is enough of a botanist in his own right to be able to do a good job of quarter-backing the Committee. I am really the only non-technical member of the Committee. My presence on it is justified not by contribution of scientific knowledge, but rather by contribution of a great deal of dedication.

The cytological studies of the Committee are under the direction of Dr. Longley, one of the leading cyto-geneticists in the United States. He gives all of his time to the work of the Committee during the months of January, February, and March. There are available to the Committee on a full-time, year-round basis, the services of Mr. Clifford Parks, a geneticist who will receive his doctorate this summer from North Carolina State College. He is employed by the Department of Arboreta and Botanic Gardens of Los Angeles County and his services are available to the Committee under an agreement with that Department.

The Camellia Research Committee is affiliated with the California Arboretum Foundation, and this affiliation makes available to the Committee and to its scientists and investigators, the very extensive facilities of the Los Angeles State and County Arboretum—lath-houses, glasshouses, laboratories, and technical equipment including a fine quality microscope with photographic attachments suitable for cytological studies. It likewise makes available the horticultural services of the Arboretum personnel.

The Committee has underway pollen studies, pigment studies, studies of the effects of various ways of making camellia crosses, and other genetic and cyto-genetic studies which have not heretofore been made of camellias on a truly scientific basis. I am not qualified to explain such technical work. However, I can outline for you, as one layman to another, projects which the Committee now has going, albeit in early stages, dealing with each of the three deficiencies in the camellia to which I have referred.

First is the attempt to develop yellow as a basic color. Mr. Clifford Parks, in addition to being a competent geneticist, is the Committee's chief investigator of color separation in flower petals, a field in which he is an expert. His studies indicate that yellow pigment exists in many of our camellia varieties in varying amounts. In almost all cases, the yellow pigment is so masked by other pigments that it cannot be seen. However, the yellow pigment can be detected by chemical studies of the petal and the making of paper chromatographic separations. On this basis, Mr. Parks has found that certain varieties have a high degree of yellow pigmentation in their petals while others, which might superficially seem to be of a yellow cast, have no yellow pigment whatsoever. These studies enable the Committee to select the best varieties for crossing in the effort to develop yellow color.

This winter hundreds of crosses have been made using pollen from white flowers which Mr. Parks considered to have the highest degree of yellow pigmentation on other white flowers selected for as much purity of white as possible, the objective being to separate

the yellow. Crosses have also been made using pollen from orange-red flowers on pure white flowers with the object of spreading the orange-red pigments sufficiently to pick up the yellow, if possible. Also, over 400 crosses were made on white flowers using pollen from the lavender and orchid colors. Pollen from *Saluenensis* hybrids was used on many of these crosses. It is hoped that the work with lavender and orchid colors may lead, not to yellow, but to other interesting color tints in new hybrids.

At the least, these various crosses should enable the scientists on our Committee to add to their knowledge of the types of genetic control which exist in the camellia.

There is another approach to the yellow camellia which is being made by the Committee. I do not believe that you will be bored by the story of it.

The genus camellia belongs to the family of plants known as *Theacea*. There is another genus of that family called *Tutcheria* which has a species, *spectabilis*, that bears flowers with a distinctly yellow tint in the petals. For several years before the bamboo curtain shut off contact, Carl Tourje used to obtain seeds of various species of camellias from the Lushan Botanical Gardens in Kuling, China. His 1948 shipment included seeds of *Tutcheria spectabilis*. He turned these over to Dr. Walter Lammerts, then at Descanso Gardens, and a plant of *Tutcheria spectabilis* now grows at Descanso. Howard Asper pollinated the camellia species *pitardii* with pollen from the *Tutcheria spectabilis*. A seed resulted which was successfully germinated; the resulting plant is now growing, and the cytological indications are that it is a true hybrid. Mr. Asper grafted the tip of this little plant on to larger understock and the grafted plant is growing vigorously and should bloom in the next year or two.

This is most exciting because, as Dr. Lammerts points out in an article in the ACS Yearbook for 1961, the *Pitardii* x *Tutcheria* hybrid may well prove to be the first step toward introducing yellow into the camellia color complex. He says that though *Tutcheria spectabilis* evidently does not have a deep yellow color, nevertheless the factor for yellow pigmentation which it contains, in combination with other color factors found in various japonica and reticulata varieties, undoubtedly would give us very lovely sunset gold shades. He points out that the situation is in many ways comparable to what happened in the case of roses, namely, the successful cross-pollination of the Hybrid Perpetual variety Antoine Ducher with the Persian yellow rose, finally achieved by the Pernetts in France, which resulted in the introduction of the beautiful Soleil d'Or.

It may take several flower generations and much further chromosome study to achieve a truly yellow camellia. But the important thing is that a start has been made, and the members of the Committee confidently expect that we will some day have camellia varieties with shades of yellow, orange, peach, coral, vermilion, and other related colors, and all sorts of new color combinations such as we see in modern roses.

The Committee has a project for inducing fragrance. As you know, we have a few japonica camellias with some slight fragrance; and this winter they were used to make various crosses. Crosses were made using "Fragrant Jonquil" as the pollen plant; "Sweet Delight" in some cases as the pollen plant and in some cases as the seed plant; and "Scented Treasure" also as both a pollen plant and as a seed plant.

Possibly more promising are crosses we have made using pollen from another species of camellia. There was brought to this country a few years ago from its native habitat, the Ryu Kyu Islands in the southern part of the Japanese archipelago, a small plant of the camellia species *lutchuensis*, the flower of which, I am told, has a pronounced and delightful fragrance said to resemble that of the sweet olive. Sufficient pollen from this

plant was available to the Committee this winter to make 50 crosses, of which 15 were made on the japonica varieties mentioned a few moments ago which have a slight fragrance, and the balance on various other selected varieties.

In 1960 Howard Asper had obtained a small amount of *lutchuensis* pollen which he used to pollinate on selected specimens of *japonica*, *pitardii* and *saluenensis*. Only one seed pod resulted, borne by the *saluenensis*. The one pod contained just one seed, but fortunately this seed germinated and developed into a plant. Mr. Asper says that the growth of this seedling shows strong evidence of true hybridity. In this case also he grafted the tip of the seedling on larger understock and we should soon have blooms.

In order to obtain more genetic stock, the Committee has also obtained scions of the *lutchuensis* plant and we now have several grafted plants of *lutchuensis* growing. This will result in an abundance of material for cyto-genetic study. We believe that we have made a good start on the fragrance project.

We on the Pacific Coast and particularly in California are very fortunate in being able to grow our camellias out-of-doors without danger of the plants being frozen. Our friends in the remainder of the camellia belt, from Texas through the Gulf States up the Atlantic seaboard to Washington, D.C., do have that danger, and the freezing spells seem to be occurring more frequently in recent years. This past winter was particularly disastrous. Not only were buds frozen, but plants themselves were damaged and, in some areas, killed.

In order to carry out its objective of promoting and perpetuating interest in camellias over as great a part of the United States as possible, the Committee desires to make all present camellia growers more secure in their plantings and also to extend the growing of camellias out-of-doors into the more northerly States. The Committee has, therefore, undertaken a project to breed cold-hardiness into the more popular camellia species. As a part of this project, we are building up stocks of the very cold-hardy sub-species of japonica known as the *Kominato* camellia brought to this country a few years ago from an area in Honshu, which is the principal island of Japan, near the 40th parallel, where winter temperatures go to 5° below zero and the climatic reports of which are analogues to those of southern Rhode Island. For many years, possibly for centuries, the *Kominato* camellia has been subjected to sub-zero blizzards which sweep down from Siberia.

The *Kominato* comes from the Sea of Japan side of Honshu and on that side there is high precipitation in the form of both rain and snow. Last Fall there was brought to this country pure line japonica material from an area on the Pacific Ocean side of Honshu where the winters are cold but not as wet as the other side, with conditions more nearly like the winters on our Atlantic seaboard. This material will become available to the Committee in due course.

With such types, cold-hardiness amounts to more than ordinary acclimatization. It has become a fixed character through centuries of survival growth. This is the type of cold resistance which can be passed on to progeny genetically. It is not for one generation only; it is for all time.

Experience in the South indicates that probably the most cold-hardy japonica camellia that we have in this country, curiously enough, is the fragile looking "Berenice Boddy", a seedling which originated in Southern California. This year pollen from the *Kominato* was used to pollinate many flowers of "Berenice Boddy".

However, crosses for cold-hardiness have not been limited to those using *Kominato* pollen. Interspecific hybrids, where plants of the species *saluenensis* are used as the seed plant, are becoming very popular in this country for many reasons. They have been

popular in England for quite a while, and one of the reasons there is their cold-hardiness. This winter the Committee made hundreds of crosses using *saluenensis*, not as the seed plant, but as the pollen plant. Most of these crosses were made on "Berenice Boddy" as the seed plant.

Dr. Longley has warned me that when I speak of hundreds of crosses I should be careful to point out that there is great variation in viability of pollen from camellia varieties as well as variations in seed settings, and that therefore we will not by any means have successful sets in *all* the crosses to which I have referred. Hopefully, however, we should be successful in a good percentage of them.

Of the things I have talked about, the most significant for the camellia of tomorrow is the crossing of the genus *Camellia* with the genus *Tutcheria*. Several species of the genus *Camellia* have been crossed with other species of that genus, but this is the first time in the history of the camellia that a cross has been made involving the genus *Camellia* and another genus. Intergeneric crossing offers a vast area for research containing much material hitherto untouched. It is entirely possible that through hybridization we can breed into the camellia desirable properties possessed by the other genera of the *Treacea* family hitherto denied to the camellia. The field is almost without limit. On our Committee we have the skills to meet the challenge, and these men have the desire and the persistence. There will be nothing visionary about their efforts. Rather, they will apply the known rules of the science of genetics to the problems that they encounter. All phases of the projects to which I have referred have been accomplished with other plants. With camellias, it is not a question of "Can it be done?". The only question is, "When will it be done?".

Vice President

Camellia Research Committee

THE TALL STATELY PALM TREES

DALE BEARDSLEY

This poem was sent to the Arboretum by this young visitor, a student from the Kingsley Elementary School, Ontario, Calif.

The tall stately palm trees,
Swing in the breeze with ease,
They reach their arms so high,
And gather secrets from the sky,
They whisper happenings of the past,
Will forever last and last.

I'd like to sit on a limb and be a bird,
I'd listen carefully to every word,
Please never, never stop talking,
As long as people 'round the Arboretum are walking.

Safari to Ohio

LOUIS B. MARTIN

1962 Annual Meeting of the American Association of Botanic Gardens and Arboretums (AABGA), held in Wooster, Ohio.

Dressed in business suit, carrying attache cases stuffed with a few clean shirts and socks, the members of the safari converged on the Wooster College Inn, Wednesday, May 30. They were to spend the next three days exploring four botanical centers: Dawes Arboretum, Newark; Kingwood Center, Mansfield; Secrest Arboretum, Wooster; Holden Arboretum, Mentor. Armed with cameras, notebooks and questions, their game was plant displays, taxonomic peculiarities and cultural secrets.

Ohio, from Cleveland south to Wooster (a small town northeast of Columbus) has never looked more lush. This spring's foliage on tree and bush was bright.

To assemble the group, a half day business meeting was held. Committee chairmen gave their reports, plans for next year's meeting were discussed and the meeting adjourned.

Lunch and then we were off to Secrest Arboretum.

Secrest is a 75 acre portion of the Ohio State University Experimental Station. Founded in 1908, the objectives of the combined Station and Arboretum serve both fundamental and applied research.

Modern brick buildings, all new, form a respective quadrangle in the shadow of the large castle-like sandstone buildings of an earlier era. Greenhouses, in numbers, furnish year around growing facilities. All these necessities appear as islands in a great green sea of clipped blue grass. As we moved out toward the Arboretum, clean white barns, green fields (protected by white fences from cud-chewing cows) and freshly plowed earth greeted our gaze. For a view of our safari transportation, please see accompanying picture.

Over narrow dirt roads we progressed through timber lots of white pine, red cedar, white oak, pin oak, tulip trees. Past the flowering crab apple collections, redbuds, lilacs, philadelphus. For the naturalists aboard, there were open meadows, small swampy bogs, understory of native wild flowers. Brown thrashers, wild canaries, red wing blackbirds and the cardinal were all seen. Even bull and green frogs made their presence known.

The twenty year old *Taxus* species and variety planting was of special note and group interest. This collection supplies culture data and ornamental potential of *Taxus* for home owners through the midwest and Eastern states. Nurserymen continue to expand the number of varieties by giving their most esteemed selections to the Arboretum.

Fulfilling its educational role, Secrest is used as a study area for botany and horticulture students of Ohio State University.

This day came to an end with a social hour, dinner, a speaker, a short walk in the cool, storm threatening night air and to bed.

Friday morning early, our chartered bus transported us, at breakneck speeds over the narrow two lane highways, with even narrower bridges, to Dawes Arboretum.

From the entrance, Dawes appears to consist of a winding unpaved road, leading to a typical Ohio two-story home of mellowed red brick. A wide front porch, painted white and a *Philadelphus* foundation planting completed the picture.

Located on State Route 13, 6 miles south of Newark, Ohio, Dawes was dedicated to the public in 1929 by Hon. Beman G. Dawes. Its purpose, "The Pleasure of the Public and Education of the Youth."



The AABGA members pose on their 'safari' wagons just before the trip through Secrest Arboretum, Wooster, Ohio.

His bequest consists of 500 acres in rolling hills, native woodland, a large lake and bogs where swamp Baldcypress grow with well developed "knees" exposed to catch the air.

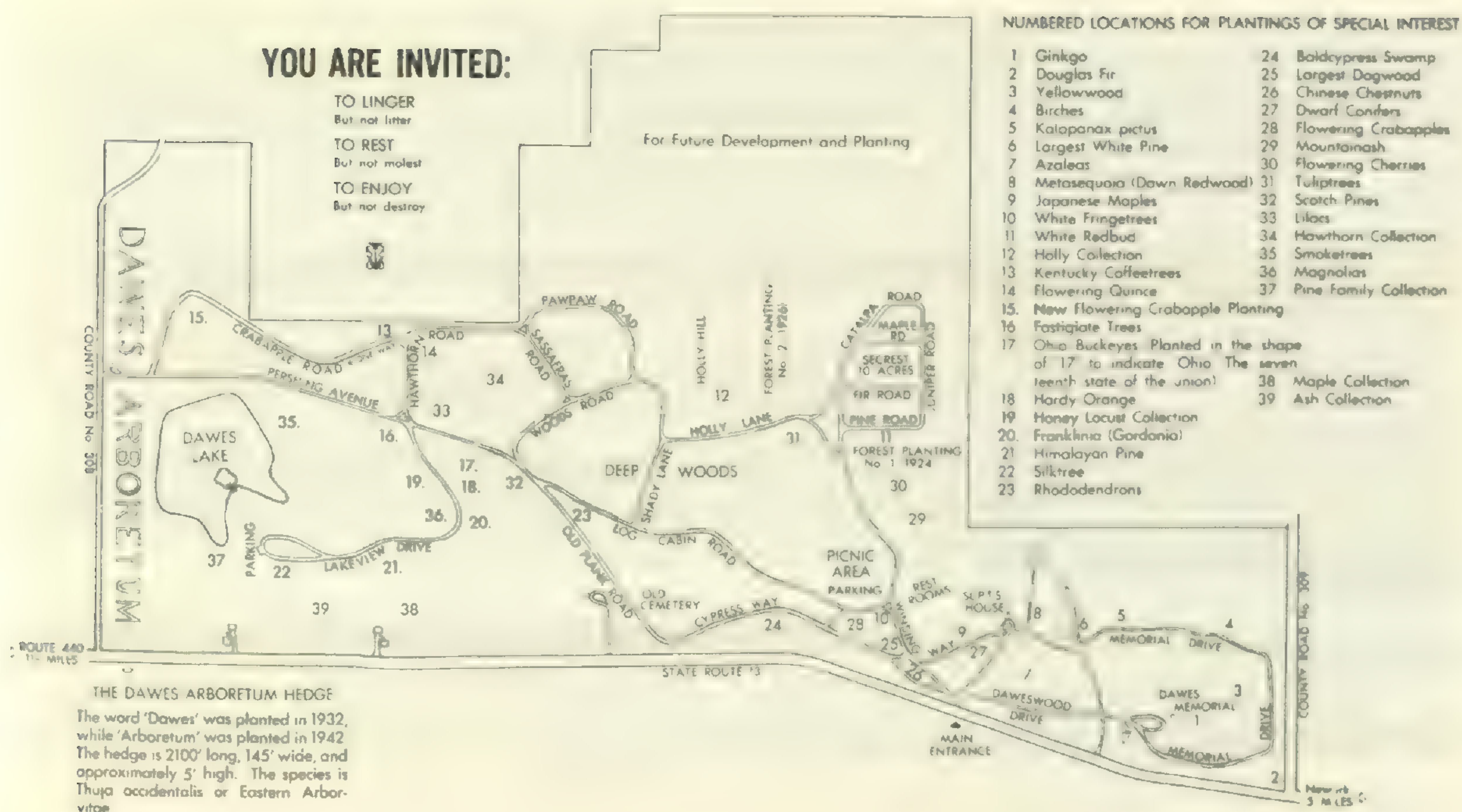
Again we boarded a tractor drawn wagon as a safari vehicle and away we went. Well not exactly. Our combined weight, there were about 50 explorers, broke a portion of the wagon. After rearrangements were made in the seating, we continued, sagging wagon and all.

We rode and tramped through forests of maples, ash, pines of many kinds, Ohio buckeyes; flowering crab apples and hawthorn collections, honey locust collection, rhododendrons; past white fringe trees, Kentucky coffee trees, metasequoias, ginkgos. And finally to the farthest point from the entrance where a gigantic hedge is located.

This hedge of clipped *Thuja occidentalis* (Eastern Arborvitae) must be highlighted. Spelling out the words "Dawes Arboretum," it is 2100 feet long, 145 feet wide and approximately 5 feet high!

One other feature assures uniqueness at Dawes. The 64 trees planted by world famous personalities, i.e. Will Rogers, Wiley Post, and General Pershing to name but a few. Each tree is marked with a large bronze plaque.

This last may not appeal to purist, but this was one man's dream and idea to attract people to see magnificent tree specimens, for years to come. The fact that Beman Dawes continued to build tree collections and finally endowed the land for posterity, far over-



shadows any quaint affectations about labelling he might have had.

We'll leave the reader much to see on his own visit but if B. G. Dawes, Jr., son of the founder, asks you into the cellar room of the house, for light refreshments, do not hesitate. It's like stepping back through history. The secret room, behind whose steel door frightened travelers of the "underground railroad" found refuge, has a temperature the year round, just right for vintage beverages.

Mid-afternoon. Back on the bus and then some 50 miles due north, our safari arrived at Kingwood Center, Mansfield. Formerly the estate of Charles K. King, his generosity of the property and a substantial endowment, given to the people of this part of Ohio, unites horticulture and fine arts.

Kingwood to the plantsman is a botanical garden; a nature trail; a changing exhibit of the finest bulb plants and annual flowers; a wealthy man's house and home. To the non-plantsman, Kingwood is an outstanding example of Norman architecture; a music recital auditorium; a fine arts gallery; a drama setting; beautifully landscaped grounds.

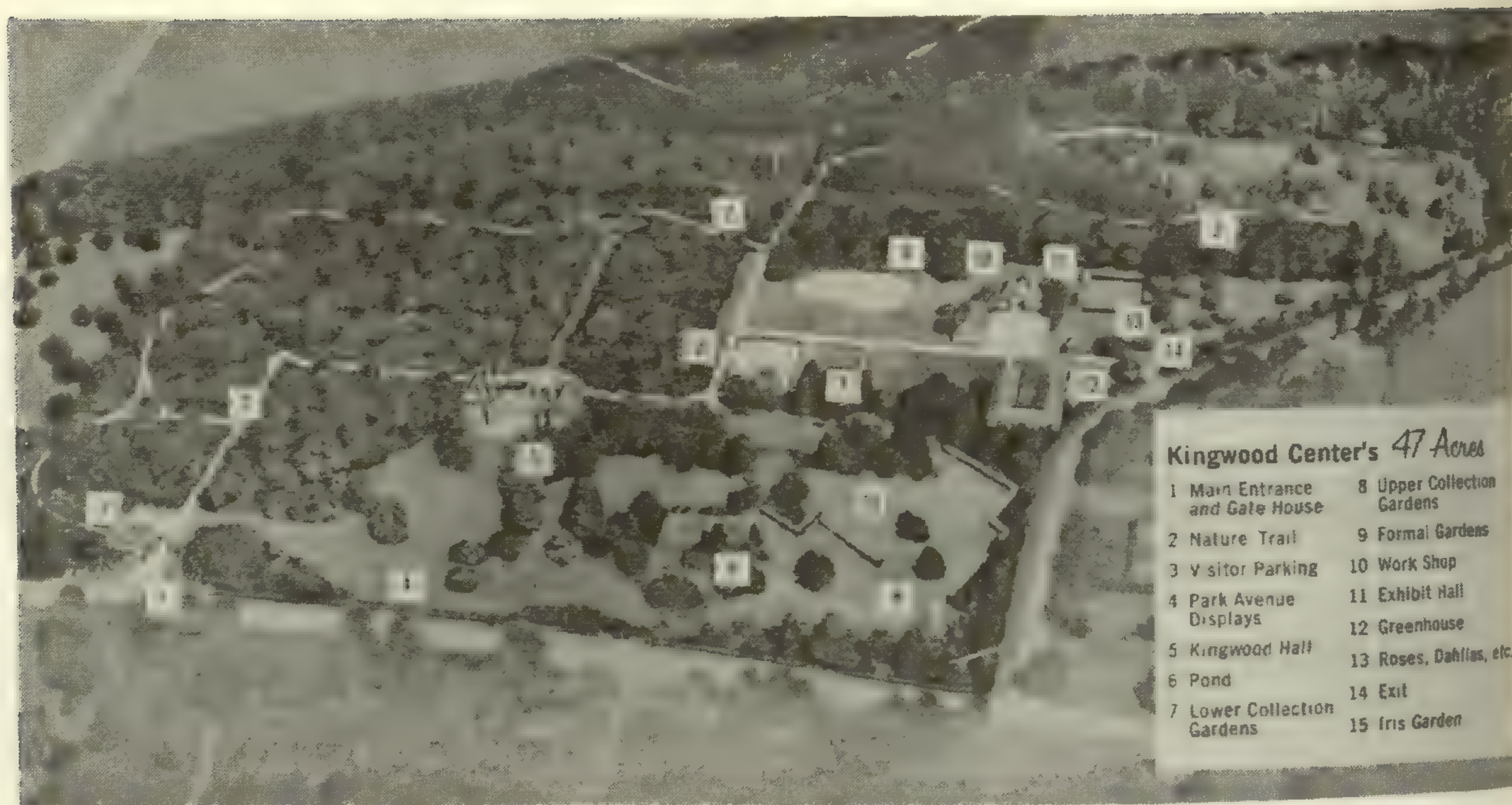
Kingwood is all of these. Plant emphasis is herbaceous, the woody material used as background settings for tulips, iris, peonies, glads and annuals. Much of the yearly color is furnished for purposes of officially testing new plant varieties.

Some 200,000 people visit Kingwood yearly. Many of these come for educational classes in botany and horticulture conducted by the various staff members.

We really did more botanizing than socializing, but when the latter is forced on one, the AABGA is up to any challenge. We were introduced to the five-man Administrative Board of Kingwood and their wives. Their warm reception and interest in our work made all of us feel very much at home. A catered dinner on the patio of Kingwood Hall closed this experience packed day.

Back on the bus, back to Wooster, back to bed. Saturday we were to go 75 miles northeast of Wooster to the Holden Arboretum at Mentor, Ohio.

Begun in 1931 with 100 acres, Holden Arboretum today, consists of 1700 acres of



spectacular native land, 35 miles east of Cleveland. Preservation of such land, while it is still available, has been an early objective of the Trustees. Although there are almost 4000 varieties of trees, shrubs and woody vines for study, plant collection development is really in its infancy.

We entered the gravelled parking area from a dirt and gravel county road. At first glance, the outer boundaries of Holden appear little different from those of neighboring farms. However, with detailed guide map in hand and headed down either the Blue or Red Trail, one finds that all similarity ends.

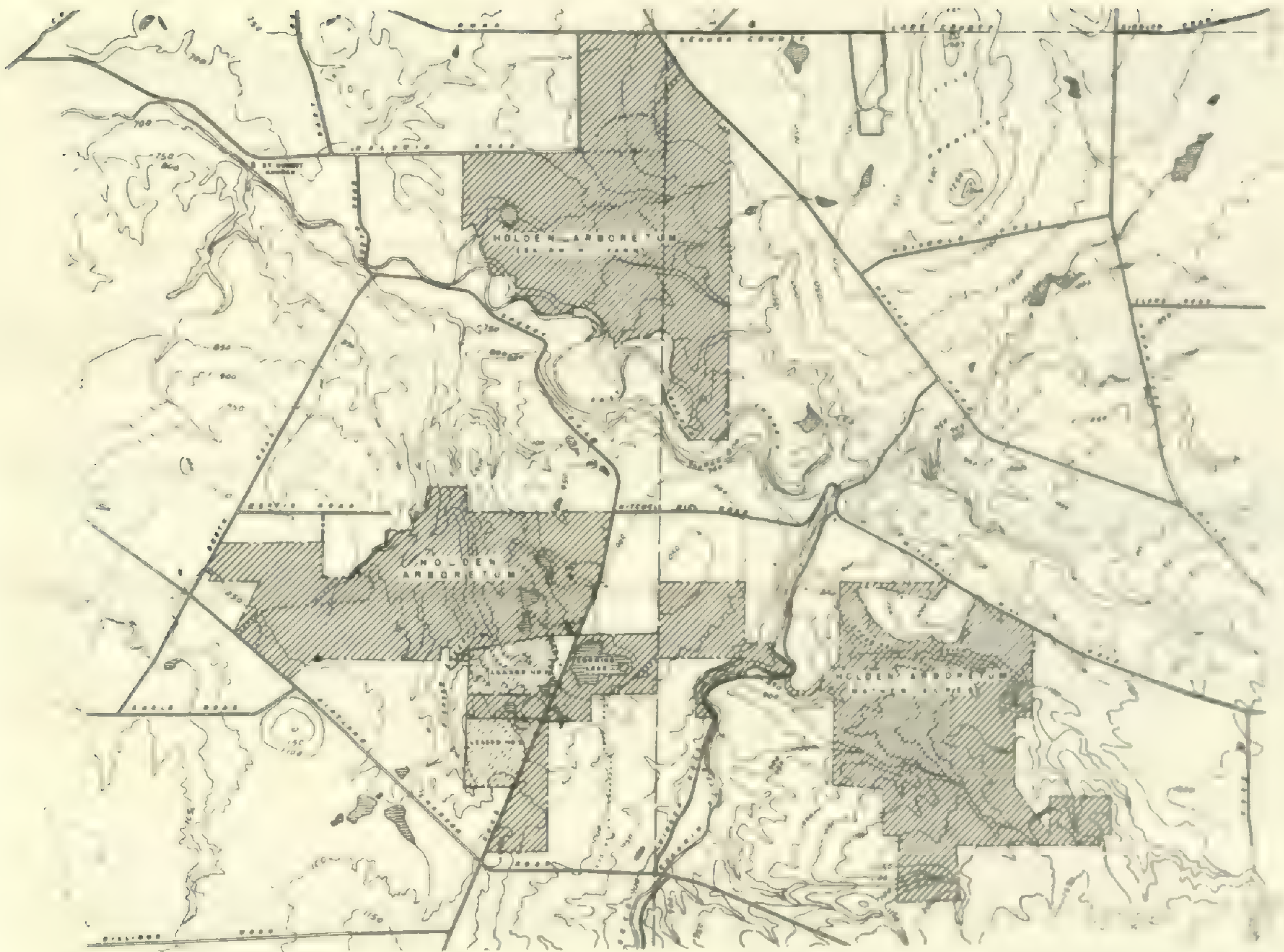
The two trails expose the explorer to: many ecological zones (Fallow Field Stage), (Thorn Scrub Stage), (Sub-Climax Forest of ash, tulip tree, red maples), (Oak-Hickory Forest) and finally (Climax Forest of beech and maple); plantings of *Pinus ponderosa scopulorum*, *Pinus contorta latifolia*, *Picea pungens*, *Picea canadensis*, *Thuja occidentalis* and *Larix laricina*. There's Buttonbush Bog and Owl Bog, each giving way shoreward to bog edge communities, such as American elm—red maple. The lilac collection in its own selected site; the privets and honeysuckle collections; flowering crab apples, hawthornes, pears, cherries and plums. A great number of the species and varieties have been labelled with large wooden display tags; however, there is still much unidentified material.

Lunch, box style, refreshed the explorers. Some were beginning to show the strain of so much hiking in the open air, away from their air conditioned offices and laboratories.

We boarded a sightseeing bus and after covering the greater portion of the 1700 acres, we stopped at the propagation and nursery area.

We never quite got over one surprise, before another appeared around the bend in these arboretums of Ohio.

The greenhouse, quite old looking was only of academic interest. The nursery beds out back were surprise number one. In mounded beds of shredded corn cobs were row on row of cuttings. The rows were approximately a foot apart and probably 100 feet long. We didn't count the number of rows, but there were many. And who could tell



HOLDEN ARBORETUM

the number of species and varieties starting out? There must have been hundreds. But this wasn't all.

A short walk brought us to the edge of the field nursery and surprise number two. What a sight. Here were two or three acres cut out of a dense native forest; however, this area consisted of row after row of specimen plants. Each row was at least 200 feet long. Here again was displayed a huge number of species and varieties. The contrast between this nursery and the typical gallon can nurseries of California was astonishing. But this wasn't all.

The cuttings behind the greenhouses, the field nursery and acres of new plantings in other parts of the Arboretum are accomplished by one propagator and his helper! Surprise three.

Holden has set an unprecedented membership attraction. Each membership offers fishing privileges in anyone of its five well stocked ponds.

About 5:00 p.m., the explorers shook hands all around, thanked the collective hosts and then scattered like quail flushed from a bush. Some north, some east, some south and two headed for California. Much plant knowledge and experiences had been exchanged, many new friends were acquired, many old friendships were renewed. It had been a wonderfully successful meeting.

Secrest Arboretum serves the largest number of the population of Ohio. The neatness of buildings and grounds, the up to date construction and the friendly nature of the

staff indicated scientific advancement, fundamental and applied, is well planned and executed. Secrest has been and will continue to be a cornerstone of horticulture for Ohio.

Dawes Arboretum represents a man's dream to preserve majestic species of the better hardwood trees grown in Ohio. One attempt toward this goal is the planting and commemoration of specimen trees by world famous personalities. There is a quiet potential of great growth and service in the future.

Kingwood Center, like Huntington Library, Art Gallery and Botanic Garden in San Marino, California, is formal, quiet, calm. Both institutions were given and endowed by men whose tastes included art, music, drama as well as plants. It is an attraction and a place of beauty and enjoyment to satisfy a wide variety of interests.

Holden Arboretum is a botanical gem, only slightly hewn from the native matrix still enclosing it. Enthusiasm of the director, propagator and very small staff assures its ultimate development as an outstanding arboretum. They have preserved a large land area; they have planted and labelled plant collections of note; they are feverishly propagating and experimenting with a large number of new genera and species; they offer a limited number of educational classes in horticulture; they regularly issue a bulletin of information. There's an impression of urgency to get on with the work there.

Chairman, Education Comm.

AABGA

The Red Jacaranda

MRS. MILDRED ORPET

Years ago, either late Roosevelt or early Truman, the plant list from the USDA offered plants of a "red Jacaranda." My husband, E. O. Orpet, ordered two, which we planted in the nursery grounds. In due course they both flowered, both the ordinary blue jacaranda. We were puzzled, but then learned that President Roosevelt, on a goodwill tour, had seen a "red Jacaranda" in Mexico and ordered the seed from the tree collected and sent to the Dept. for propagation and distribution.

Later, a customer, who had been to Mexico a great deal, came in and we told her the story, whereupon she began to laugh. She said that in the plaza of a city down there (she thinks it was Guadalajara now, but has forgotten the incident—alas don't we all forget!) there stands an enormous jacaranda which is almost smothered with a red bougainvillea. Naturally, when the tree isn't in bloom and the bougainvillea is, it must be a striking sight. So the mistake was made! I wonder how many other nurserymen order the red "jacaranda"—and if anyone else has run down the source? At all events, now that we have a white and a blue jacaranda it's too bad we don't have a red one.

Santa Barbara, California

The Aesthetic and Recreational Values in Botanic Gardens

ELIZABETH ANN MOREL

PART 3

Parts 1 and 2 were published in Lasca Leaves, Vol. XII, No. 1 Winter, 1962, pp. 12-18 and Vol. XII, No. 2 Spring 1962, pp. 41-48.

OUTSTANDING PRESENT DAY BOTANIC GARDENS:

THEIR VALUES AS NOW CONSTITUTED

Values of the present day botanic garden are many. The most obvious and easily appreciated values are, of course, the scientific research studies carried forward, the educational programs conducted, and the aesthetic and recreational pleasures to be derived from garden visitation.

As experimental and research stations, botanic gardens provide for collection and study of the native flora of the country in which they are located, thus keeping close check on all natural plant resources and their possible exploitation. Continuously, the new developments in plants are tested and evaluated for all conceivable uses. Botanic gardens serve as centers for the introduction of improved plant varieties, displaying these novelties so that the public itself may judge them. New methods for the propagation and growing of plants are developed and tested. The collections of plants are used to breed new varieties, better adapted to local climatic conditions. Studies are made of plant diseases and of methods for overcoming them. Experiments are conducted in soil improvement and fertilization.

As an educational institution, a botanic garden may offer, directly, courses and lectures as well as instructional trips within the garden for adults and for children of all ages.

Seen as a beautiful park, much more diversified in its contents than any other park can be expected to be, a botanic garden provides for its casual visitors a relaxation and release from the continual mental tension which civilization exacts from the city dweller. Such a garden becomes a center of display for the most desirable garden plants; it offers stimulation to all those who garden for themselves or who appreciate the beauty of plants.

THE BOTANIC GARDEN

AS AN INSTITUTION FOR SCIENTIFIC RESEARCH

The value of the botanic garden as an institution for scientific research is evident. Stated objectives for the operation of most botanic gardens include these: (1) providing means for scientific investigations, (2) carrying on plant breeding programs, (3) making exhaustive tests for climatic fitness, hardiness, and the like, and (4) provision of a laboratory for students and investigators. These evidence at least the intent to contribute value to mankind through scientific investigation and advancement.

The presence of a library and herbarium, as well as great collections of living plants, makes the botanic garden and arboretum the ideal center for scientific horticultural study, discovery, and research. In an herbarium, botanists from all parts of a country or over the world may avail themselves of the opportunity to study the collections and to work on problems involving nomenclature, classification, and evolution of plant groups. As Dwyer has written, "The training of students herein serves to perpetuate the heritage of a science which is absolutely essential to botanical and scientific progress." Merely to mention all of the research projects undertaken by these institutions would be an exhaus-

tive compilation of many different interests. However, the value of their undertakings may be seen clearly by noting some of the projects of no more than a few of the present day botanic gardens, the variety and scope of which are not only interesting but surprising.

For example, among the immediate and longer range objectives of a new research program at the Brooklyn Botanic Garden is the identification of plant products which may be useful in combating human ills, such as those caused by disease-producing microorganisms, nutritional deficiencies, physiological and mental disorders, aging, and abnormal growth of cells as in cancer. In collaboration with the Sloan-Kettering Institute for Cancer Research, one of the main projects now under way is the isolation of useful microorganisms from soils, for their effectiveness in cancer therapy. Other current research projects, also related to human welfare, concern study of plant growth and organisms from the sea.

In contrast, the research activities carried on at the Missouri Botanical Garden during a recent year are quite differently oriented as to objectives from those of the preceding institution. Interesting to note among them are the studies made of succulents and of house plants, research on methods of orchid growing, trials of plants from Korea, Turkey, and Japan; they include studies on water lilies, studies and practical trials of lawn grasses, and of both food and cover plants for birds. These projects differ from the ones mentioned earlier in that they are relatively easy to relate to parts of the garden which visitors can see and appreciate. This garden has also been active in specific phases of plant breeding, mycology, taxonomy, and paleobotany; it has contributed to the general scientific knowledge of these subjects. Another institution, the Blandy Experimental Farm Arboretum of Virginia, which lists experimental and research work as its chief functions, specializes in highly technical work concentrated in the fields of cytology and genetics. Examples of its work include the colchicine treatment of *Tropaeolum majus*, chromosome studies of many plants, inter-varietal, inter-specific, and inter-genetic crosses, cytotaxonomic and genetic studies on the Aristolochiaceae and the Solanaceae, and the embryogeny of *Crepis* with the aid of x-ray induced chromosome rearrangements.

In view of the recent interest of the people of the United States in the progress of the USSR, it may be worth while to note the focus of research at the Main Botanic Garden of the USSR Academy of Sciences at Moscow. The garden there is charged with the following tasks: (1) to investigate methods for using and cultivating the vegetative resources of the Soviet Union and of foreign countries as the national economy may require, (2) to work out a scientific basis for the cultivation of plants in the city, and (3) to disseminate botanical knowledge and information on the practical use and cultivation of plants. In addition to his statement of objectives, Dr. P. I. Lapin has reported a primary interest of the garden as "use of the resources of our vegetation for plant breeding by groups concerned with immunization and seed growing." He further explained, "We have laboratories for the study of the physiology of plant development in connection with biochemical, embryological and growth stimulating factors, for experiments in remote hybridization." From his account it would appear that the scientific research work of the garden is mainly devoted to the plants in the various collections and exhibits, and that present investigations include the following: (1) direct trials of plants in new conditions and a study of their variation, (2) methods of selection of the initial material, taking into account the geographical, historical, and ecological fac-

tors, (3) methods of growing plants which may increase their hardiness against the limiting factors of the environment, (4) breeding through hybridization and especially remote hybridization, (5) investigation into the rhythm and stages of development in the introduced plants, (6) the determination of the most important embryological, physiological, biochemical and anatomical factors affecting plant growth, development, pathology, and immunity. Recently, according to report, important scientific and practical results have been achieved in the crosses between cultivated wheats and wild species of quack grass, a research sponsored by and occurring at the facilities of the Moscow garden.

By way of comparing values, a look is in order at some of the public service aspects of scientific projects undertaken by the Los Angeles State and County Arboretum in southern California. The research program of this institution includes a number of substantial projects, perhaps the most extensive being the introduction and test growing of new ornamental trees and shrubs for civic and residential planting. Plants are being introduced from countries with climates similar to those in southern California,—Australia, Central and South America, South Africa, and many of the countries bordering the Mediterranean Sea.

Two factors are necessary, it should be noted here, in order to realize full value from this aspect of plant introduction, (1) an appealing display of the new plant material, and (2) availability of this new plant material. Obviously, after determination that the new plants will grow satisfactorily, if they are not attractively displayed there will be little demand for them. Following adequate display, if the demand exists, the material must be made available to the public, and although the plants are displayed at an arboretum or botanic garden, usually they are not sold there. Therefore they must be distributed to retail nurserymen. In the California situation, an act of the state legislature has authorized the sale "at not less than cost" of new plant material to nurserymen. Thus the final link is provided in the chain of plant introduction programs so that they may render to the community their full value.

A second important research project at this institution, and an outcome of the plant introduction work, is the study of fire resistant plants. This work centers on a problem of southern California, that many of the native shrubs and slope cover are very susceptible to fire damage. In addition to devastation by fire, the director of the Los Angeles State and County Arboretum points out, the resulting soil erosion and watershed loss are of a very serious nature here. For this reason, he says, "we are seeking drought and fire resistant plants to grow as barriers around areas of high population in the foothill portions of Los Angeles County, and along the main highways in the foothill and mountain sections."

Another research project in the public interest, now under way, is aimed at determining the effect of air pollution on ornamental plants. This is of importance because, unfortunately, the atmosphere of this region is often highly concentrated in smog. The universities and similar agencies have taken advantage of facilities at the Arboretum and have located research projects here, to study in addition the effects of smog on agricultural plants and on plant biochemistry.

The development of the "flower carpet," sponsored through a grant from the Longwood Gardens and Foundation, is an additional project of some interest. The work on this is showing that small flowering plants can be grown on pieces of plastic foam, supplemented by watering with chemical nutrients. Carpets of these are now beginning to

be widely used in floral displays and in garden exhibits.

Although such examples of plant study may seem out-of-the-ordinary to persons unacquainted with its many facets, these may well be considered as no more than a quick cross-section of the types of study and research which are taking place in many of the botanic gardens of today. It is the common aim of plant scientists, botanists, and horticulturists the nation over, "to contribute sound fundamental research, each in his own field of interest or study, to the common store of mankind's basic knowledge about plants."

(Part 3 to be continued)

Penny Pool's Phonetic Phantasy

FRANK HALVORSEN

Petite Penny Pool patiently proffered palatable pellets to her pet peahen, parturently pondering her plight while patulously perched over nine eggs placed pediculously on a pallet near the phormium in the planter by the Gatehouse.

Penny's pennate pal palpitated over the pernicious peccadillos of a philandering pixilated peacock. Prowling predators procured five eggs, possibly as a prandial portion intended to pacify predatorial progeny, mayhap even pensive poltergeists. Proper procedure for Penny's peahen in her present predicament presented problems. Parental phenomena provided persuasive purpose. A plausible prognosis produced a placebo for patience. Parching heat, penetrating percipitation, parades of passing people pestered Penny's peahen prognosticating parenthood, or possibly partenogenesis, perish the phobia.

Passing periods programmed proper propriety. Now! Proclaim the perspicacious phenomenon! The progeny pipped, protruding a head periscopically from under the plumed parent. Penny pirouetted prettily, periling production.

Proudly, the patient peahen preened platitudes for Penny, prolonging pronouncements. The pubescent poult peeped in protest, preferring promenades for provender. Penny's peahen perused the three remaining eggs and profoundly pronounced them putrid. She then prevented psychosis by profanely punching presentably preeminent portions of proselyting peacocks as she paraded proudly past with her precocious punk protecting posterity.

Postscript: These professorial polysyllabic profundities only mean—the peahen by the Gatehouse laid nine eggs and hatched out one this Spring.

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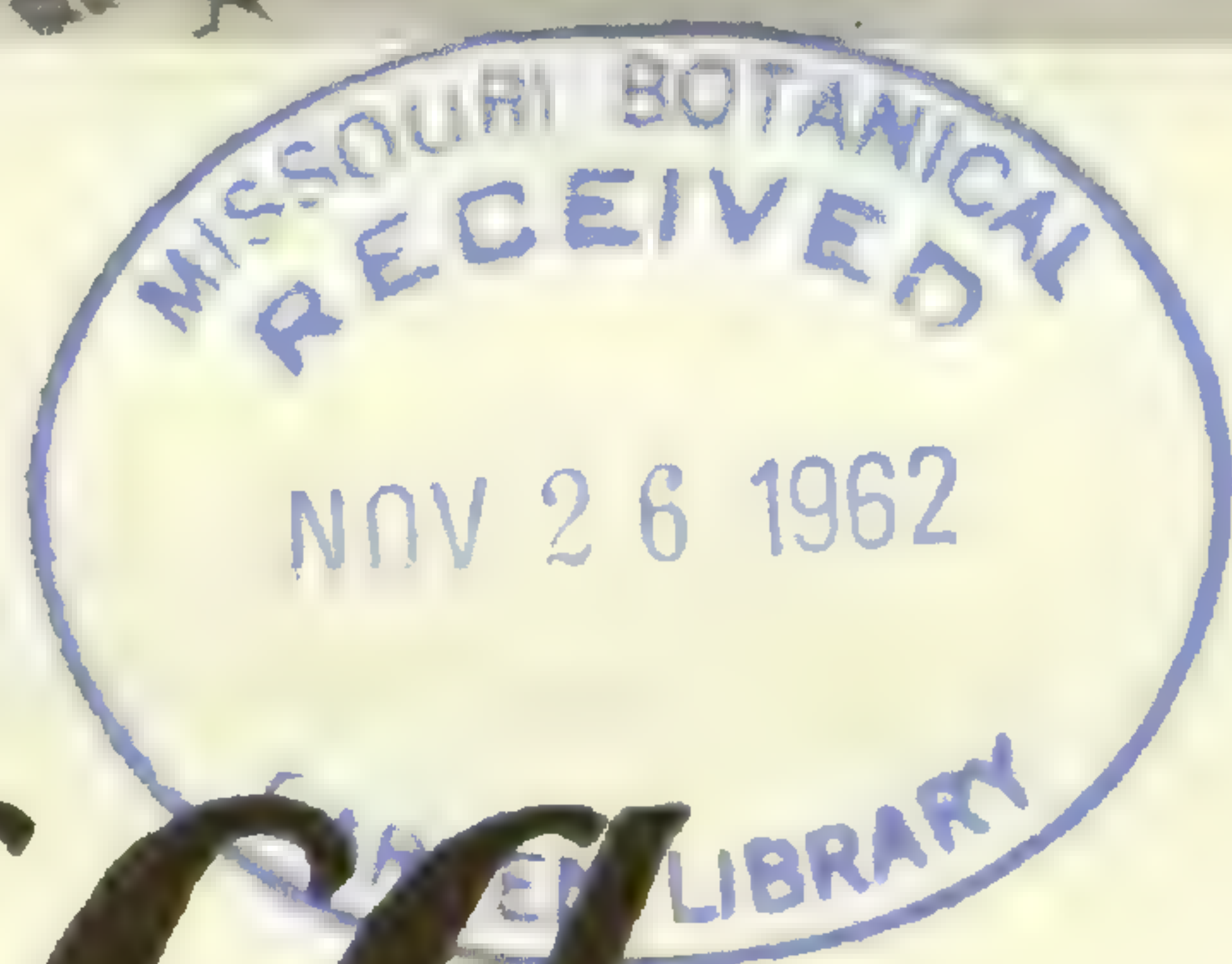
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Silver Linden



Tilia tomentosa, called Silver or White Linden. This tree was planted in 1955 and is now 18 feet tall and has a lateral spread of 12 feet. Photo: Denis Kucera

SILVER LINDEN

ROSS GOODRICH

Linden trees are scarce in the southern part of California. Our climate is usually considered unfavorable to them, but two trees of a variety said to be better able to stand heat and drouth than other lindens have been doing very well at the Los Angeles State and County Arboretum.

These are *Tilia tomentosa*, called silver or white linden. Here the word silver seems about as appropriate as common names usually are. The dark green, almost round leaves do have a light silvery underside. They measure up to four and five inches across. The trunk and upright branches have a smooth grey bark. These trees have been slow to grow but for the most part very healthy and bug free.

The significant factor in their performance is that their leaves have stayed entirely green until fall each year and have had no burned edges after about the Fourth of July or soon after the spring fogs end, as is the case with many of our deciduous trees.

The tree pictured was planted in 1955 and is now eighteen feet tall and twelve across. The second tree was planted the following year and due to crowding by the unexpected growth of some neighboring trees had to be moved. Since both trees had been in a lawn and were rather protected from extreme heat it was decided to further test this ability to stay green through our dry summers by putting this second one in a more open spot, again in a lawn, but where heat was radiated to it from black top pavement. The results have been good. This is the third summer since moving and the leaves have stayed green as late in the year as on the other tree.

Though *Tilia tomentosa* is reported to be able to stand heat and dryness better than other lindens, it seems that it has been overlooked by linden admirers for testing in this area. None are known to have been available from nurseries in the west. It could be worthwhile to try them here. They are clean looking and stately; their appearance would be a good addition to our local landscaping and street plantings. It is planned to grow more of them at the Arboretum for planting in other locations. The experience so far suggests that it will be rewarding.

Arboretum Gardener
Asiatic-Pacific Section

California Arboretum Foundation Gifts

The California Arboretum Foundation, Inc., is most grateful to Mrs. William Warren Orcutt for three very significant gifts, made in the name of her husband, the late Mr. William Warren Orcutt, noted petroleum geologist.

The first is a handcrafted polychromed wooden Madonna of Gothic style predating 1800, holding a staff and carrying a symbolic insignia within her left arm. The robes, footgear and particularly headgear, place it within the period of religious folk art representative of the Northern Germanic School under which artists from the Scandinavian countries would have been artistically influenced. The Orcutts acquired the Madonna many years ago in Denmark. This interesting madonna will be temporarily displayed in the Arboretum rotunda display case in order that it may be viewed closely by the public.

The second item, an interesting stone bowl, thirty-seven inches in diameter and approximately thirteen inches in depth, has challenged the speculation of several anthropologists and historians and the consensus of opinion is that it is an old baptismal font, its provenience undecided, but which was ascribed by Mr. Orcutt as having been at the

original La Purissima Mission prior to its destruction by earthquake. The five stones comprising the base of the font are from the lime kilns of the San Fernando Mission. The font has been installed beneath the beautiful old camphor tree in the patio of the Hugo Reid Adobe.

The metate completing this fine contribution to our collection is an excellent example and is a most fitting addition to the Adobe.



The Madonna measures 16" high. The over-all measurement of this art piece is 26" high by 12" wide. Photo: Vincent Chang

Rock Roses - Cistus

Components of the shrub vegetation and their usefulness in soil conservation
RÜDIGER KNAPP

The parts of California with chaparral and live oaks dominating the natural vegetation, are not the only regions in the world with rains in winter. Nor are they the only regions with extreme drought during the summer, causing plant cover in non-irrigated areas to be dry and susceptible to fires. There are climatically similar areas in the Mediterranean, South Africa, Australia and Chilean regions. Indeed, parts of the Mediterranean region have especially similar conditions, since the distribution of rainfall and the history of vegetation is highly comparable to the situation in certain areas of California.

TABLE 1
Climatic conditions in some Mediterranean and California stations
(data after Schenck 1939)

TEMPERATURE (averages in Farhenheit)													
	Jan.	July	Year										
Sevilla	50	84	67										
Palermo	50	76	63										
Adana (Turkey)	51	82	66										
Ojai (Calif.)	50	71	61										
Sierra Madre (Calif.)	51	71	62										
PRECIPITATION (averages in inches)													
	Jan.	Feb.	Mr.	Ap.	May	Jn.	Jul.	Ag.	Sep.	Oct.	Nov.	Dec.	Year
Sevilla	2.6	2.0	2.6	1.8	1.7	.6	0	.1	.8	2.4	3.1	2.5	20.4
Salermo	3.2	2.4	2.8	1.9	1.1	.6	.2	.4	1.8	3.2	3.3	2.7	23.8
Adana (Turkey)	6.4	5.6	3.6	2.0	.4	.2	0	0	.2	1.2	4.8	6.4	30.8
Ojai (Calif.)	5.6	4.6	3.0	1.3	.6	.08	0	0	.4	.7	1.3	3.0	21.7
Sierra Madre (Calif)	4.8	4.6	4.7	2.2	1.2	.6	0	0	.4	1.1	1.7	2.8	23.9

Near the Mediterranean coast, the slopes of the mountains are often covered by evergreen shrubs with rather small, thick, sclerophyllous or even needle-like leaves. The rock roses, species of the genus *Cistus*, are important components of this shrub vegetation. These plant communities, comparable to California chaparral, are called "macchia". It may be emphasized that the Mediterranean macchia does not usually cover such large, uninterrupted areas as California chaparral. This is due to the higher density of rural population in the areas adjacent to the Mediterranean. The slopes of the mountains are used cultivation of olives and other plants. For this purpose, terraces are often constructed by man on the slopes to prevent soil erosion and to promote an accumulation of top soil. But areas for grazing of goats, sheep and other livestock are still more important in the Mediterranean mountains. As a result of such grazing, the macchia can be replaced by open plant communities of grasses and small low shrubs with branches pressed close to the ground. This deterioration of vegetation cover can result in heavy soil erosion. As in many places in California, Mediterranean sclerophyllous shrub vegetation alternates with pine forests. The most important of its pine species are: *Pinus halepensis*, *P. pinaster* and *P. pinea*. When fires occur, the vegetation most affected by the flames are often these pine forests. This is a different behavior than with the situation in California. Apparently, the Mediterranean macchia is generally more fire resistant than the California chaparral. There are not so many adaptations for a fast regeneration after fires in the species composing the Med. macchia, as there are in California chaparral. The fires occuring in the macchia are, in most cases, made intentionally by the rural population to get browsing area for the livestock. Such fires are rather common in some areas, for instance in the island of Corsica. New species, more fit for pasture, develop on the burned areas. Also, the young shoots of some macchia shrubs appearing after the fires are preferred for browsing.

Table 2, gives an idea of the species composition of the macchia. Some genera represented here are quit lacking in California. It is remarkable that a number of the most important California chaparral genera are totally absent in the macchia, for instance, *Ceanothus* (mountain lilac), *Arctostaphylos* (manzanita), *Adenostoma* (chamise), and *Dip-lacus*.

TABLE 2

SPECIES COMPOSITION OF SOME STANDS OF MEDITERRANEAN MACCHIA

1. MYRTUS-CISTUS MACCHIA on siliceous soil near Bordighera (Italy) at 200 m elevation on SW slope, 20° inclination. (Knapp 1953)
 - a) Vegetation covering 85% of soil surface.
 - b) More than 25% of surface covering: *Calycotome spinosa*, *Rosmarinus officinalis*.
 - c) Five to 25% covering: *Cistus salviifolius*, *Dorycnium suffruticosum*.
 - d) Other evergreen shrubs: *Myrtus communis*, *Daphne gnidium*, *Pistacia lentiscus*, *Phillyrea angustifolia*, *Chamaerops humilis*, *Arbutus unedo*, *Lavandula stoechas*, *Erica scoparia*, *Cistus albidus*, *Cistus monspeliensis*, *Juniperus oxycedrus*, *Spartium junceum*, *Euphorbia spinosa*.
 - e) Lianas: *Clematis flammula*, *Smilax aspera*, *Lonicera implea*, *Rubus ulmifolius*, *Rubia spinosa*.
 - f) Other plant species: herbs, grasses, chamaephytes, etc., 16 species.
2. RHAMNUS ALATERNUS-PISTACIA MACCHIA on limestone soil near Andora, Italy at 40 m elevation on S slope, 30° inclination. (Knapp 1953)
 - a) More than 25% of surface covered by *Pistacia lentiscus*.
 - b) Five to 25% covering: *Rhamnus alaternus*, *Euphorbia spinosa*, *Pinus halepensis* (young plants).
 - c) Other evergreen shrubs: *Myrtus communis*, *Phillyrea angustifolia*, *Coriaria myrtifolia*, *Spartium junceum*, *Calycotome spinosa*.
 - d) Lianas: *Smilax aspera*, *Rubia peregrina*, *Asparagus acutifolius*, *Clematis flammula*.
 - e) Other plant species: 13.
3. CISTUS MACCHIA between Ceuta and Teutuan, Morocco, North Africa (Rubel 1930)
 - a) Only evergreen shrubs mentioned: *Cistus ladaniferus* (dominant), *Cistus monspeliensis*, *Quercus coccifera*, *Chamaerops humilis*, *Lavandula stoechas*, *Phillyrea variabilis*, *Pistacia lentiscus*, *Cistus clusii*, *Daphne gnidium*, *Calluna vulgaris*, *Erica scoparia*, *Erica umbellata*, *Juniperus phoenicea*.
4. CISTUS MACCHIA near Chania, Creta, Greece (Rubel 1930)
 - a) *Cistus salviifolius* (dominant), *Cistus crispus*, *Erica vericillata*, *Arbutus unedo*, *Calycotome villosa*, *Lavandula stoechas*, *Poterim spinosum*.



Map. 1. Distribuiton of a rock-rose species, *Cistus salviifolius* (hatched areas) in the Mediterranean region. (after Rikli 1943/48)

(This map copy sent in reverse form from European source.—Ed.)

Among the genera lacking in California, *Cistus* is the most important. The rock roses are distributed in several species over the whole Mediterranean flora region from sea level to considerable altitudes. Table 3, shows the altitudinal range of some *Cistus* species. The distribution of *C. salviifolius* is demonstrated by Map 1. *C. salviifolius* is one of the species with the largest area. The other *Cistus* species are represented only in smaller parts of the Mediterranean region.

TABLE 3

ALTITUDINAL RANGE OF SOME CISTUS SPECIES IN SOUTHERN FRANCE
AND CORSICA
(AFTER FOURNIER 1946)

<i>Cistus laurifolius</i>	0 to 1600 m (5248 ft.)	<i>Cistus albidus</i>	0 to 1200 m (3936 ft.)
<i>Cistus salviifolius</i>	0 to 1350 m (4428 ft.)	<i>Cistus crispus</i>	0 to 500 m (1640 ft.)
<i>Cistus monspeliensis</i>	0 to 1200 m (3936 ft.)	<i>Cistus villosus</i>	0 to 300 m (948 ft.)

Some *Cistus* species prefer soil originating from silicatic rocks, while others are found in limestone soils. There are vast areas with *Cistus* species absolutely dominating the vegetation. In many cases, *Cistus* appears only as an admixture in vegetation mainly composed of other evergreen shrub species. Often, the rock roses appear only as a few individuals in macchia stands. There are also macchia communities without *Cistus*. (See Table 2).

Compared with a number of chaparral shrubs and other plants of the macchia, *Cistus* affords a relatively dense vegetation cover especially in certain dry, rocky situations. The rather broad leaves are green over the whole year. Plant communities with predominating *Cistus* have a considerable influence on the microclimate (Knapp and Linskens, 1953).

Cistus stands destroyed by intentionally burning, regenerate well. *Cistus* appears more fit for regeneration after such fires, than many other macchia plants. Compared with a number of California chaparral plants, the fire resistance of the rock rose seems to be much better, as was demonstrated by the experiments of Martin and Juhren (1954).

These are properties very desirable for the purpose of soil conservation in the mountains of Southern California. Therefore, the successful experiments and plantations carried out by G. Juhren (1956, 1958) and continued by Stewart, Ching, *et al* seem to be very important.

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The Aesthetic and Recreational Values in Botanical Gardens

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Part 4

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ECONOMIC VALUES

The economic values of present day botanic gardens evolve directly from the research and scientific projects carried on within them; in this connection it is important to note that the term *economic* carries in many cases the meaning of the term *application of scientifically gained information*.

In historical gardens, outstanding economic gains were made by propagation and distribution of new or unusual plants. The guidance of the various botanic gardens in the use of these plants has led to significant results in history, even to changes in national economics concerned. Perhaps the first work of that kind accomplished was the introduction of the breadfruit tree from Pacific tropical islands to the West Indies in 1791 by a Kew gardener, Christopher Smith. Two other remarkable successes in this section of the work of Kew Gardens have been the introduction of quinine to India and of Para rubber to the Malay Peninsula. The experiment of introducing the quinine plant from Peru to the hill countries of India was undertaken in 1860. This achievement has been considered one of the most successful and most profitable of its kind. When it is remembered that this drug (quinine) was for many years the only specific for malarial fever, the commonest and most often fatal of tropical diseases, it will be realized how great a service the reduction in the cost of this drug has been to dwellers in the tropics. Its present price is about one-sixteenth of what it was in 1860.

In comparatively recent times, few articles of tropical origin have been put to so many uses and become so nearly indispensable to civilization as rubber. Most valuable of the rubber yielding plants is the Para rubber tree, *Hevea brasiliensis*, native to Amazonian forests of Brazil. Since the natural supplies of this product, though immense, were all but inaccessible, the authorities at Kew Gardens determined to create fresh sources. In 1875, seeds of this plant were sent to Kew, and from these seeds a thousand plants were grown and delivered to Ceylon and the Malay Peninsula, there to provide the basis for one of the great industries, not only of the East but of the whole civilized world. Among smaller but still important products which may be credited in major part to the work of botanic gardens are cocoa and tea. In 1880, plants of *Theobroma cacao* were sent to Ceylon from Trinidad, to lay the foundation for a new source of supply; at this time the great bulk of cocoa came from South America. The tea industry of Natal was still another which had its beginning in plants obtained from Kew.

Modern botanic gardens experiment with matters having aspects of economic importance, and although their achievements may seem less dramatic than those of earlier times in affecting the history and industry of nations, nevertheless they are of definite and positive value. Generally, a major concern today lies in improving the performance and characteristics of many different plants. The particular purpose of the Eddy Arboretum in Placerville, California, is the breeding of pines by the use of genetic principles for improved timber production; the hope in this work is to produce faster growing pines for lumber, and for reforestation, and to combine with rapidity of growth such features as wood quality and resistance to insects and disease. Another current project of applied research has to do with horticultural uses of plant hormones. Here the

focus is upon various means of propagation and rooting of cuttings. Tests of the use of gibberellic acid have shown interesting responses in the increase of fruit size, and an increase in the speed of germination. At Manitoba the Experiment Station, active in growing fruits and ornamental species, has issued a quantity of valuable information regarding new and improved varieties of hardy material.

Thus it seems apparent that the "applied scientific" advancement in botanic gardens is of economic interest and importance in the present day just as it has been historically.

EDUCATIONAL VALUES

"An arboretum or botanical garden," in the words of Donald Wyman of the Arnold Arboretum, "may be used for public enjoyment and recreation, but is primarily established for the education of the public." Plants are properly labeled as well as recorded, usually with a certain amount of information about the plants themselves, about their culture, and about their ornamental or economic use. In botanic gardens the effort has been to plant and maintain an extensive collection of many kinds of labeled plants for critical examination, for scientific study, and for the education of the public.

Of the objectives stated by botanic gardens and arboreta, that one which most clearly indicates educational intent seems to be, "To disseminate knowledge of plants to the public." This "knowledge" generally includes information regarding plant identification, appearance, and culture. In addition, some gardens sponsor a continual display of those plant varieties which might prove to be the most valuable and adaptable to the various uses in a given climate (*i.e.*, shade trees, wind barriers, city beautification).

Dr. John Merle Coulter, in a dedicatory address delivered at the Brooklyn Botanic Garden in 1917, spoke of the educational service contribution of a botanic garden. He said, in part:

Nature is a great teacher when she really comes in contact with the pupil. The notion is all too prevalent that knowledge comes from books, that one can read about nature and acquire knowledge of nature. Knowledge comes from experience. We must distinguish between knowledge and information. Knowledge is firsthand, obtained from actual contact with the material. Information is second-hand, hearsay, coming from no actual experience. Reading about plants therefore brings information; contact with plant material brings knowledge. To serve a community by bringing its children into contact with nature and plants is a great educational service.

Specifically, the public may draw educational value from a botanic garden in a number of ways. An individual may visit a garden out of curiosity, to see and learn what a botanic garden is and does. This might well be termed the casual approach: the knowledge gained is incidental, and the person is likely to be seeking enjoyment rather than education directly. A second reason for visitation may be to seek knowledge purposefully, of some aspect of plant study; with this purpose the intensity of interest of course varies with the persons concerned. The belief is rather generally held among botanic garden and arboretum administrators, at least, that "only by providing an educational experience for each visitor is mere existence justified." Such experience accrues indirectly to the botanical garden visitor in the observation of correctly labeled plants, information signs, botanical and horticultural displays, publications, automatic slides and motion pictures, taped informational talks, and even trail signs, to mention but a few. Direct education may be offered in a number of ways: information centers at the gatehouse or garden entrance, guided tours by information aides (*docentry*), guided tours by other staff members for special groups, educational field trips, and by individual consultations as well as the special and regular classes.

In many of the present day botanic gardens, regular classes are held both for children and for adults. One group of people who have been quick to take advantage of this

service includes home owners, who come to see and hear and gather ideas on "how to plan or "how to do" for themselves, either visually in demonstration home gardens, or audibly and visually by attending a class which offers explanation of some phase of plant study or of landscape design. A person who is eager to learn more about a hobby may take courses in orchid culture, tree identification, botanical sketching, plant pathology, or birds and plants as they relate each to each, among others. For the children, actual participation in gardening and study of plant life is often available, with talented and able supervision; says Wooley, "young people are eager to learn, and these subjects have a waiting list long before the starting date." Lectures by staff members are presented in many modern gardens, to various garden clubs and nursery organizations. In this way, particularly, valuable information is disseminated with regard to new plants and their horticultural requirements. Plant research of course serves education as do also the many published articles sponsored by most present day botanic gardens. Lastly, an increasing use of the botanic garden as a main center of horticultural information, much in the same way as the reference department of a library, is indicated by the numbers of telephone calls from people desiring limited information or answers as to where certain information may be located. Clearly, these are educational services.

It is of some interest to note that the very early botanic gardens contributed to public knowledge by providing labeled specimens, but that courses for the public and instruction by experienced teachers are relatively new contributions. In the gardens of the past, actual instruction was offered only to regular students of pharmacy, botany, or related subjects; the Padua Garden is believed to have been the first of these, about 1545.

Information aides (docentry) are said to be a comparatively new idea in the program of education; they are found mainly in those institutions devoting a considerable portion of time to the popularizing of knowledge. Under this system, a regularly appointed "docent" travels a definite route throughout the garden at a specified time each day. Groups of people may start with the docent, or he may in turn meet with two or three interested visitors, volunteer information concerning the trees and plants of the collection, "and thus assemble an extempore class."

The botanic garden can be said, then, to be a valuable source of knowledge to casual visitors as well as to horticulturists and plant scientists and to student groups interested in various phases of plant study. For specific examples of the educational programs now being conducted in outstanding botanical gardens of today, the following descriptions are offered in the knowledge that fully described programs would require many more pages than are available here.

Botanic gardens associated with a university or college were developed, in the majority of instances, with education as one of their main objectives. Association with a university is often an advantage in that it tends to assure permanence to a botanic garden or arboretum; further, sound and intelligent advice on problems of the garden is sure to be available from university staff and faculty, while the garden can serve as an ideal out-of doors laboratory to augment classroom instruction. Facilities offered by a botanic garden are often used to greater advantage as a result of this association, than might otherwise be the case. The botanic garden at the University of California at Berkeley, for instance, which lists teaching as one of its chief functions, serves, in addition to its other functions, as a source of plant materials required for class instruction in many of the departments of the university. The same is true of the botanic garden on the Los Angeles campus of the University of California.

The New York Botanical Garden, affiliated with Columbia University, indicates its educational purpose by the following comment:

This great scientific institution is actively engaged in fulfilling the needs, of

plant education . . . of a great urban metropolis. Its display, greenhouses, formal beds, rock garden, and various scientific exhibits are all carefully presented to the public to promote an interest in—and a greater appreciation of—plants.

Lectures, tours, and classes for adults are all part of the program. The great herbarium and library are constantly in use by students from all fields.

A garden with similar purpose but not connected with a university is the Brooklyn Botanic Garden. Donald Wyman has written,

. . . this botanic garden, situated in the heart of a great city, has been doing a splendid work in child and adult education . . . Urban dwellers who come in contact with the garden receive benefit from its interest in teaching of horticulture and the lore of growing plants. No botanic garden could be in more difficult environs, yet possibly because of this, the Brooklyn Botanic Garden continues to render to the people of Brooklyn a real service in teaching the appreciation and beauty of plants as well as their culture.

The Morton Arboretum in Illinois, listing education as its chief function, places considerable emphasis on the establishment of clearly marked nature trails and, interestingly, in the education of children. Classes are given, however, not only for the general public but for instructors in plant study as well. Walks, tours, lectures, and photographic contests are among the ways of interesting pupils as well as their teachers in the plants of the arboretum. Classes in gardening, nature study, and landscape design are conducted for the benefit of all. Valuable information can be learned from the Morton Arboretum as to methods used in its various phases of public education.

The Bowman Hill State Wild Flower Preserve, of Pennsylvania, is said to demonstrate clearly "how effective a well managed cooperative effort can be in education for plant conservation." This garden places exceptional stress on the importance and need for conservation, as its objective, through a comprehensive program of education for increased appreciation of wild flowers and native plants. Those interested in wild flower conservation and display may learn techniques in this garden, especially for labeling and for maintaining and protecting the various collections.

As has been stated, the majority of the botanic gardens in operation today provide some form of program to educate the public in one or many phases of plant study. To list them all or to mention all the ways in which they provide this service would again, as with the many scientific values, produce volumes of information unnecessary to attest further to the educational riches available from botanic gardens. The energies of many people connected with the educational aspects of plant study are boundless, in spite of sometimes limiting funds and resources. To mention the efforts of one garden is not to slight another not mentioned, but only an attempt to give an interesting and clear, but concise, picture of the abundant values and the even greater potential offered by these institutions.

(To be continued)

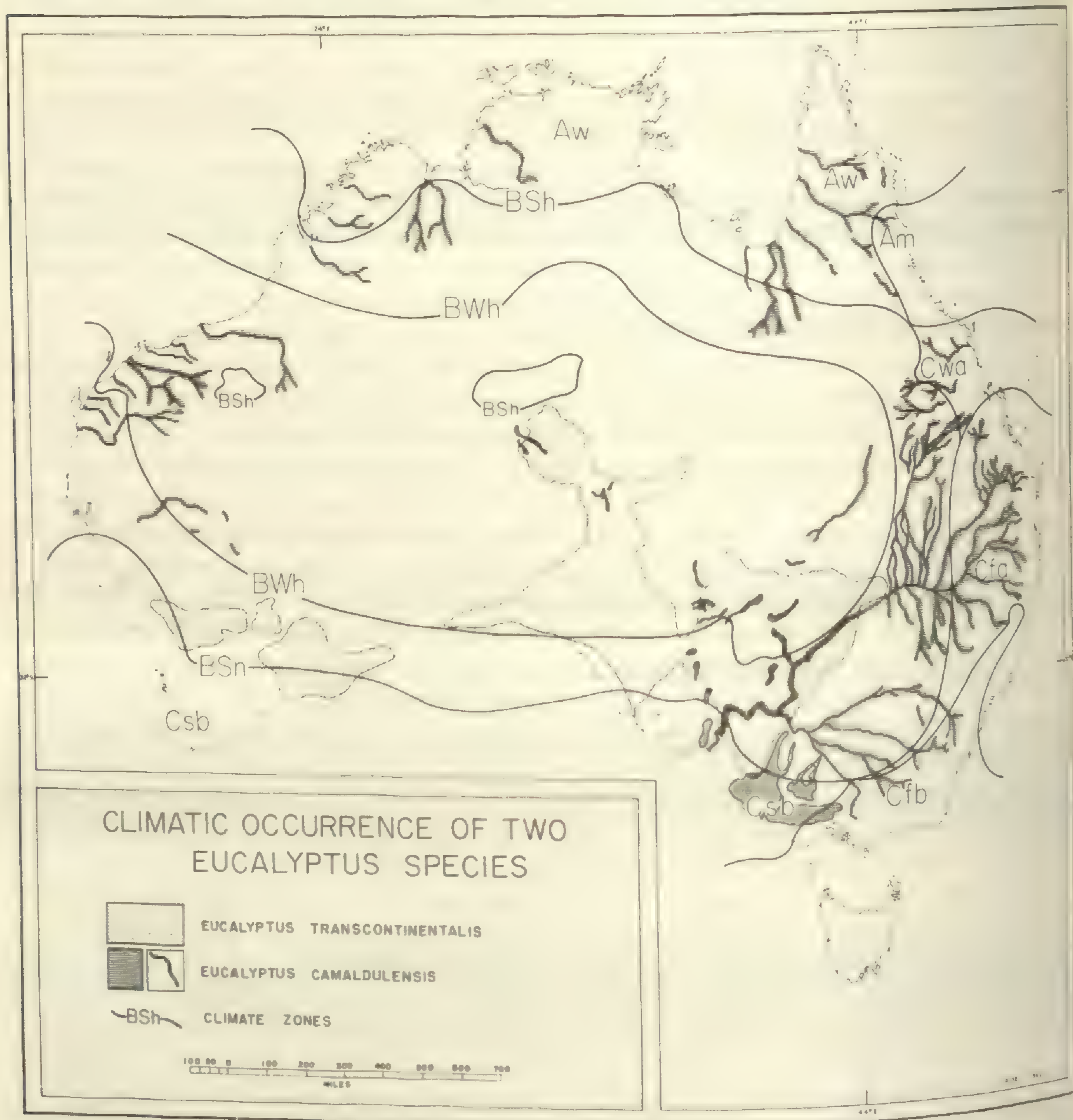
THE CLIMATIC OCCURRENCE OF TWO EUCALYPTUS SPECIES

GERALD W. GAUSE

The distribution of any flora depends mostly on the climate in which it is found. The Australian continent displays a variety of climates suitable for varied types of plant communities.

Out of the six hundred known endemic species of Eucalyptus on the Australian continent, there are two which have the widest geographical distribution throughout all of the climatic regions. The species we are concerned with are highly adaptable and include: *Eucalyptus transcontinentalis*. Maiden. (The Boongul) and *Eucalyptus camaldulensis*.

Dehn. (Murray Red Gum). As we can see on the climatic reference map, both species have a wide range as far as ecological preference is concerned.



Australian continent showing climatic regions and occurrence of two Eucalyptus species on uplands and along drainage basins.

Type "A" Tropical Rainy Climates: Coolest month above 54.4°F . Rainfall is above 35" and small daily range in Temperature. Annual range only 2°F . Plants referred to as Megatherms and can endure excessive rainfall.

Region Am. Tropical Monsoon: Short dry season. Total rainfall enough to support rain-forest. Mean annual temperature around 80°F . Rainfall above 40" to 200".

Region Aw Tropical Savanna: Has a dry season in winter. Is found poleward from the equator, and rain comes from migratory equatorial moist air masses when the sun is high. Temperature range is greater than the Tropical Monsoon.

Type "B" Dry Desert Climates: Potential evaporation if water were available—is greater than any measureable precipitation. Very large annual temperature range. Extreme maximum temperatures. The plants are Xerophytes and can endure drought with high temperatures for long periods of time.

Region BW. Desert: Annual temperature greater than 64.4°F . Daily range often over 40.0°F . Effectiveness of rainfall depends on season in which it occurs. Usually found toward interior of continents.

Region *BS. Subtropical Steppe*: Due to milder temperatures and an increase of rainfall a short grass prairie and shrub vegetation occurs. Precipitation usually 10-20 inches. High temperature range.

Type "C" *Humid Mesothermal Climates*: Distinguished from "B" by a sufficient amount of precipitation. Mean annual temperatures from 26.6°F. to 64.4°F. This type is usually found on the subtropical margins of the middle latitudes. The climatic regions are divided according to the temperature and precipitation and length of summer seasons as one goes toward the poles. The vegetation in this climate is able to withstand both cold and warm conditions.

Region *Cs. Mediterranean Dry Summer*: With a winter maximum in rainfall. Has marine influence extending inland for some distance.

Region *Cf. Humid Subtropical*: More than 2.4" in each month of the year. Duration of warm season depends on latitude.

Region *Cw. Winter Dry Mesothermal*: Usually associated with the "Am" Monsoon. Lower temperatures usually attributed to higher elevation or higher latitude keep the average annual temperature below 64.4°F.

SUBTYPES

- a. Warmest month above 71.6°F. (Hot Summer)
- b. Warmest month below 71.6°F., and 4 months above 50.0°F. (Warm Summer)
- f. More than 2.4" rainfall in each month of the year.
- h. Hot and dry; mean temperature all months above 64.4°F.
- s. Summer drought; rainfall in driest month has to be less than 1.2" in order to be classes as "w."
- "s" subtype.
- w. Winter drought; rainfall in driest month has to be less than 2.4" in order to be classed as a

Eucalyptus transcontinentalis: As a tree in western Australia it may grow from 50'-70' high. Going eastward it appears as a mallee (native name for Eucalyptus thicket; shrubby species with a bulbous rootstock from which ascend several stems) and towards the arid interior it appears as a low suppressed marlock (dwarf species of Eucalyptus with a reduced rootstock) in discontinuous isolated clumps. Being a more xeric species it has no preference for a high water table.

Its principal occurrence is from 24°-35½°S. In western Australia and western south Australia it is found on extensive plains from 1000'-1400'. In New South Wales and Victoria it is found on lower hills and plains at 500'-1300'. The climatic map indicates its preference for the "BSh" and "BWh" climatic zones with extremes in daily minimum and maximum temperatures. Maximum readings during the day may well be over 100°F, and minimum night readings may drop to 35°-40°F. Thus, this species is able to endure diurnal ranges in excess of 50°F. Minimum record temperatures in the cool season may go as low as 24°F. Rainfall throughout this zone is from October to March and may be only three to four inches in the western part of its range. Average rainfall throughout its range is 9"-15". The number of days of rainfall occurrence is 40-80. In the northern part of the "B" climates rainfall variability lessens and measurements are more uniform throughout the year.

The climatic map shows that the Boongul appears in an open and continuous distribution throughout the greater part of its range, and is not confined to ecological niches. Its appearance on the map places it in open and exposed areas; thus it has no preference for mesic conditions.

This species is a more durable and xeric type; suitable for planting in the high Mojave Desert and the low Colorado Deserts here in southeastern California.

When young its natural growth is in a mallee form, but if adequate water is supplied it will quickly loose this habit. Its natural mallee form makes it ideal as a border planting, in a rockery or a lawn specimen with a unique appearance. Heavy watering is accompanied with rapid growth during the warm season. For planting purposes the Boongul grows on sandy to medium clay loams. Solanized brown soils are also suitable.

When in bloom, the flowers are very attractive with bright yellow filaments. The anthers are broad thick and white. The juvenile leaves are glaucous and sessile. They are

broadly lanceolate to narrowly ovate 4 cm. broad and 2 cm. wide. The mature leaves are glaucous, petiolate, lanceolate and acuminate 10 cm. long and 2 cm. wide.

Propagation by seeds is rapid; immediate transplanting into one gallon cans is desirable for rapid growth.

Eucalyptus camaldulensis: (Murray Red Gum) This is a very lofty tree from 80-120'. Its maximum size depends on the climatic region in which it is found growing. The bark is very smooth and deciduous. It is usually a dull white or ash color. The young branches are a brown-red color and show four different faces or plates which fade out as the branch matures.

The Murray Red Gum occurs in pure stands in river valleys and on flood plain areas. It is found in the "Aw" Savanna Woodland formation at widely spaced intervals. In this zone the species develops a magnificent globular crown. Lack of competition in this zone can account for its graceful appearance.

As far as distribution is concerned, it is found from 15-38°S. Its principal occurrence is 33°-36°S. This is where the climate has allowed the species to grow to its optimum form; and it is probably in a dynamic equilibrium with the climate. This is undoubtedly the center of origin for the species.

In southern Australia it is found on terrain that is regularly flooded. In areas of low rainfall (10-15") this species relies on a fairly high water table. It will grow on badly drained flats which dry out when no rainfall occurs. In southeast Australia it is found at elevations of 50'-1000'. In south Australia it is found up to 2000'.

Reference to the climatic map indicates that the species has a definite interest toward mesic conditions and prefers river bottoms. Its discontinuous distribution from one river bottom to another portrays a good example of polytopy. (Polytopy is defined as species of a genus that occupy more than one single distinct area separated from each other by barriers; such as small bodies of water or landforms.)

In all regions of Australia the root system of this species is regarded as a perfect binder for banks of water courses, thus protecting them from erosion. This species withstands winter frosts but is also found in the frost free areas of Australia. Throughout most of its range it is subject to some type of seasonal drought. Its ability to endure winter drought in north Australia and summer drought in the south shows its remarkable adaptation possibilities.

Record maximum temperatures in its range are from 85°F., to 98°F. Minimum temperatures are from 23°F., to 26°F. There are 40-150 days of rainfall occurrence. Average rainfall in its range is 10-25". The growth form of the tree of course depends on the amount of rainfall received and the season in which it occurs. If the rain comes in summer it is usually in greater quantity, but less effective because of higher temperatures and greater evaporation. Winter rainfall is more effective if temperatures are not too low, and adequate percolation into the ground will replenish water supplies for spring growth.

E. camaldulensis is found growing with *E. transcontinentalis*, but only at higher elevations. The appearance of *E. transcontinentalis* is rather sparse at these elevations. The present stands in the northwestern portion of western Australia suggest a one time richer flora under more mesic conditions.

The flowering period depends on the climate. When in bloom it portrays a fairly large white flower. The juvenile leaves are opposite with three to four pairs. They are petiolate and slightly glaucous. They are narrow to broad lanceolate 6-9 cm. long and 2½ to 4 cm. wide. The mature leaves are alternate and petiolate at 12-22 cm. long and 8 cm. wide.

For planting purposes the species will obtain optimum growth under silty soils of great depth. It will also grow well in sandy soil with sub-surface moisture. *E. camaldulensis* is probably one of the most adaptable species in the genus. Its ability to withstand extreme climatic conditions enables it to be used in many areas. It is used extensively for windbreaks in arid and semiarid areas and also as a shade tree. Its moderately hard wood is used for a variety of things in Australia.

SUMMARY

From reference of the climatic map one can see that around 5/6 of Australia is under arid and semiarid conditions. The country is approximately the size of the United States with 2,948,366 sq. miles, (U.S.A. 3,082,809) and possesses some of the world's most lush and outstanding vegetation. *Eucalyptus* species along with *Acacia* species can be found growing all over the Australian continent. The Australian vegetation has an identity of its own which is quite different than any flora here in the northern hemisphere.

With emphasis on climatology one is able to understand the ecological requirements of plants that can be introduced into the United States; whether for agriculture, horticulture or forestry, suitable research on adaptation requirements is essential for fruitful results.



Eucalyptus camaldulensis. A handsome and graceful specimen located on the western side of the Australian Plant Section at the Arboretum. Photo: Denis Kucera

COVER PICTURE

The Animal Kingdom original is in color, measures 3½ feet square over-all and was created by George T. Hastings of Santa Monica, Calif. A companion chart, The Plant Kingdom, is equally illustrative. Mr. Hastings, a retired high school botany teacher, is the author of *Tree Book of Santa Monica*. Photocopies, 8 x 10, b/w of both charts are available from the California Arboretum Foundation, Inc.

WEATHER RECORD — 1961

Los Angeles State and County Arboretum, Arcadia, California

TEMPERATURES						EVAPOR-	RELATIVE	
MONTH	AVERAGE		PEAKS		MEAN	RAINFALL	ATION	% HUMIDITY
	MIN.	MAX	MIN.	MAX.		INCHES	INCHES	
January	44.5	74.7	36	89	59.6	1.60	2.630	.30
February	44.9	72.3	40	85	58.6	.01	2.745	.37
March	44.4	70.7	40	87	57.5	1.02	3.195	.41
April	48.3	76.3	40	101	62.3	.31	4.645	.37
May	51.0	73.8	46	91	62.4	.01	5.180	.49
June	56.3	83.9	46	96	65.1	—	5.695	.42
July	61.5	89.6	54	102	75.5	—	7.525	.45
August	62.2	90.3	55	102	76.3	—	7.870	.45
September	56.6	86.4	51	101	71.5	.03	5.905	.40
October	52.3	81.8	44	105	67.0	—	4.905	.42
November	44.5	71.0	36	90	57.8	2.31	2.700	.44
December	40.5	66.0	36	77	53.2	2.75	1.740	.45
Total Inches						8.04	5.4735	

J. T. MCGAH, Plant Recorder and Weather Observer

WEATHER RECORD — 1961

University of California, Los Angeles, Subtropical Horticulture Area

TEMPERATURE						PRECIPITA-
MONTH	AVERAGE		PEAKS			TION
	MIN.	MAX.	MIN.	MAX.		TOTAL MONTH
January	48.9	75.2	39	91		1.51
February	47.8	72.4	41	82		0.00
March	48.1	69.3	44	85		0.79
April	49.5	71.9	44	92		0.27
May	52.6	71.3	48	83		0.02
June	57.6	74.7	50	86		0.00
July	63.2	80.9	56	88		0.00
August	63.2	80.1	57	91		0.22
September	58.7	77.9	51	98		0.03
October	53.4	75.9	43	102		0.00
November	45.7	68.4	38	88		2.71
December	42.5	64.7	37	79		1.92
Total inches						7.47

Due to problems in instrument adjustment temperature data may not be completely reliable.
Prepared by Lyle Pyeatt

MANDEVILLA SPLENDENS

The plant identified as *Mandevilla splendens* in Lasca Leaves 11:83 (1961) has been found to be of hybrid origin. It has been named *Mandevilla* × 'Alice du Pont'. For complete information refer to the article by D. G. Huttleston in *Baileya* 10:1 (1962).
The plant at the UCLA Botanical Garden has lived through two mild winters thus far. We are hopeful that it will tolerate cooler winter conditions.

Coming To The Parson

MAIDA BOYLE

A charmingly sculptured plaster group bearing the above title, gifted to the "Queen Anne Cottage" in 1954 and safely esconced on its original pedestal in the Study. It draws many interested comments from the hundreds of visitors to that lovely 'fairy-tale' building. Presumably one of the 100,000 groups sold in the thirty years between 1860 and 1890 by sculptor John Rogers, it is representative of the unique growing appeal for 'art in the home' which burst upon the American scene immediately after the Civil War and before the depression of the 70's. Coming To The Parson shows a benign minister holding a newspaper with the banner head "The Union". He is smiling inquiringly up at two shy young people. A dog sniffs at their heels, a cat, arching its back, watches the dog. At one time, in the 'sixties', this group adorned a window area in Philadelphia.

John Rogers was to become one of the artistic phenomena of his time. A sculptor for the people, essentially American and entirely 19th Century in his attitudes and philosophies, he very early presented a distinct talent for modelling in clay, along with a rare cognizance of public moods. Starting life as a mechanical draftsman, he amused himself by making miniature figures in clay, exhibiting such tactile joy in working with this three-dimensional material, that family and friends continually prevailed upon him to seriously take up the study of sculpture. In 1858 he arrived in Rome, but almost immediately realized he was not interested in the classical style then so prevalent. High art was not for him. Rogers' interests were in the study of human nature and its foibles, and a firm belief that sculpture should and could tell a story . . . the least concerns of sculptors of the day. A few months later, he had returned to Chicago and another draftsman's job, spending more and more time on modelling his little figures until in 1859 he presented "The Checker Players" to a charity fair. It was the hit of the Bazaar, people delightedly commenting on its accuracy of detail and the realistic attitudes of the figures.

This success prompted consultations with an Italian craftsman well versed on bronze casting. Visual sculpture is generally more complex in principle, making greater demands upon the artist. Rogers' insistence that his groups achieve the excellence required of a fine artist, necessitated specific techniques that would allow quantity production at prices low enough for public consumption, but retention of artistic quality. By 1860, he was busily working toward this end in a studio at 212 Fifth Avenue, New York. Soon Rogers' reputation soared and a magazine, *Farm and Fireside*, wrote: "What Hogarth is in pencil, Canova and Michelangelo in marble, Reynolds on canvas—all these excellencies in art have their illustration in the plasters of John Rogers."

Such accolades, for there were others, were pleasant, but Rogers was in business. Slowly, after moving to a larger studio, he built up a collection of perfectly modelled, very salable groups to be marketed mainly through jewelers and stationers shops and by mail. One such advertisement in *The Century* magazine of 1883, is shown in the illustration.

With every group went elaborate instructions for unpacking to prevent damage, and instructions for mending, plaster not being a strong material, recommending clear shellac instead of glue, and for restoration of the surface, a mixture of zinc white and burnt umber.

The anecdotal "Rogers Groups" as they are now called by collectors became the delight of everyone whatever their station in American society of that thirty-year period. His "documentaries" were never very profound but showed the genuine talent of an extremely observant artisan. In 1864 adding glamour to his already fast growing popularity, President Lincoln a recipient of one of his groups sent a cautious but pleased



Rogers' "Coming to the Parson" was a gift to the California Arboretum Foundation, Inc.

Photo: Denis Kucera

letter of acknowledgement.

Very few American artists have achieved such universal admiration as John Rogers. For many years evening parties would be planned and tableau performed of his comic illustrations of the Washington Irving stories, historical groups, lovers scenes, soldiers returning from the wars, family groups in various representations of life and habits of the times, etc. The live participants dressed in white, their hands and faces whitened, posing in the exact Rogers attitudes before a black velvet background . . . shades of the Laguna Art Festival!

Historically, the "Rogers Groups" depict certain Americana of the latter part of the 19th Century, enlivening the too often flat, precise datum of the historian. More specifically, they represent the impact of industrialism on public taste—that combination of the practical and aesthetic so essential to the American ideal. Though in 1864, the founder of that excellent collection of primitives at Yale wrote: "In America, the present is an epoch of monstrous plaster figures daubed with crazy paint; of mammoth cast-iron wash-basins called fountains . . ." still later, this famed art critic-collector, James Jackson Jarves, son of the establisher of the famous Sandwich Glass Company, in an article for the *HARPERS NEW MONTHLY* of 1873 was to write the following: "We know no sculptor like John Rogers of New York, in the Old World, and he stands alone in his chosen field . . . a genuine product of our soil, enchanting the fancy, enkindling patriotism and warming the affections by his lovely, well-balanced groups in plaster and bronze.



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Although diminutive (they were rarely above 16" in height) they possess elements of greatness. His is not a high art, but a genuine one of a high naturalistic order based on true feeling and a right appreciation of humanity."

We, here at the Arboretum, are most fortunate to possess such an important item in the Collection.

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The Two Lives of James Jackson Jarves, Francis Steegmuller, New Haven, 1951

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Arboretum, Arcadia

BOOK REVIEWS

Cacti, by Walter Kupper, translated and edited by Vera Higgins, illustrated by Pia Roshardt. London, Nelson, 1960. 126 p., 60 plates. \$10.00

Orchids, by Walter Kupper, translated by Jean W. Little, illustrated by Walter Linsenmaier. London, Nelson, 1961. 128 p., 60 plates. \$10.00

Here are two beautiful books by Walter Kupper which are collectors' items for anyone who cultivates these tropical plants. In *Cacti* the sixty plates showing ninety species were drawn in colored crayon, then softened with a moist brush; when dry, the detail was again outlined with crayon. The resulting life-like plates appear hand-colored rather than reproduced. For each plate there is a short plant description as a footnote to the opposite page giving scientific name (and new name of genera in parenthesis), popular name, habitat, distribution, size and description of the flowers and plant. Mr. Kupper says, "Zürich can boast of owning the most comprehensive collection of cacti and other succulents in Europe today, the Municipal Succulent Collection . . . illustrations have been painted from specimens in the Zürich Collection." In his excellently written text he brings forth some interesting and amazing information. Cacti are of American origin, the greatest number of species found in Mexico, South America and Southern United States. In the chapter on cacti as pests the author tells of the *Opuntias* which were imported to South Africa, Madagascar, parts of India, Ceylon and Australia. Several species were spread by seed to cover ten million acres in Queensland and New South Wales and were finally checked by the importation of a large moth *Cactoblastis cactorum*, from Argentina. Cacti are used for food by Mexicans and Indian tribes as cattle fodder, and as a source for the drug Peyote or Mescaline and cochineal dyes. Other chapters give botanical descriptions of environment and plant forms, the spines, the flowers, and fruit, seed and vegetative propagation.

In the *Orchids* there are sixty colored plates by Walter Linsenmaier, with descriptions giving habitat, flowering period, size and coloring of the flowers and plants. "For the most part they have been painted from specimens in the Zürich Botanic Gardens"—some of these plates are brilliant and others of delicate coloring. Here again is an even more absorbing text by Mr. Kupper. Over half the text and the captions to the plates are concerned with botanical information about these astounding and varied plants. He takes up the distribution of the twenty-thousand species of the orchid family which are found in Europe as well as the tropics; the habitat of orchids which varies from terrestrial to epiphytic; habits of growth that are connected with a fungus; the root and shoot formation; leaves and flowers which vary tremendously as orchid flowers are designed to be fertilized by insects; and the formation of the fruit. He then discusses the introduction of tropical orchids into Europe, mainly credited to English explorers and seafarers who sent plants to Kew and the fantastic prices for orchids which grew out of the excitement of the introduction of new species and the rivalry among growers. There are chapters on hybridization, tropical orchids in cultivation, and indoor cultivation of orchids. Unfortunately, like so much life in the tropics, there is a decline of orchids in their native lands. The author devotes a chapter to conservation. Urbanization and professional collectors are the chief hazards to plants.

Both books are works of beauty, scientifically accurate and interesting to read.

DORA GERARD, UCLA



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The Functional and Aesthetic Aspects of Ceramic Planters

VICKI LITTLE JOHN

Ceramic planters are becoming an increasingly common item in the Southern California home. Due to its popularity it is worthy of analysis and consideration, not only as a functional item but as an aesthetically attractive and beautiful component towards achieving a picturesque and exciting garden scene.

Before proceeding with an analysis of ceramic planters it is first necessary to define exactly what is meant by the term "ceramic planter." The word "ceramic" refers to any article formed of clay and hardened until vitrious by a process referred to as firing. The term "planter" refers to any receptacle used for the purpose of containing and maintaining the life of a plant. A ceramic planter is, therefore, any vessel made from clay used for the sole purpose of containing a plant. Needless to say, planters are not only made from clay. Other materials such as wood, cement, plaster, plastic and innumerable synthetic materials are used quite extensively. Clay is, however, one of the most successful materials in regards to its functional characteristics. It is also the traditional material used in the production of planters.

The use of ceramic planters has developed in the United States from the role of a simple, decorative window items to integral and important features in garden landscaping and interior decorating. Past cultures in the Orient, Spain, Mexico, Italy and the majority of the Mediterranean countries made great use of ceramic planters. The same is true even today. Within the past few decades, the United States has also begun to use ceramic planters extensively. This is directly related to the present concepts of contemporary architecture which lay emphasis toward spacious interiors and exteriors, walled and terraced patios, swimming pools, garden entrances, cement, brick or stone decks, stairways and balconies. These areas all are greatly enhanced by planters that may break up space, serve as sculptural entities, create various levels, or simply border and trim modular and free form areas.

Ceramic planters, in their role today, may be used as safe receptacles for rare and delicate plants or as portable units. As a portable unit the garden scene may be easily changed or a particular plant may be set apart for special admiration. In the various roles it plays, the planter is an essential tool in integrating the landscape with the architecture.

A garden or yard is usually planned around a particular structure. Consequently, it is essential that the landscape and architecture be related. The ceramic planter can do much to provide this relationship by harmonizing with the various building materials and at the same time contain a green and living thing — a plant. This unit helps establish the desired relationship between buildings and the surrounding garden or landscape.

As stated earlier, there are two main categories to be concerned about upon consideration of ceramic planters; the technical or functional and the aesthetic. The functional aspects involve the physical structure and characteristics of the planter while the aesthetic involve the actual appearance of a ceramic planter containing a plant. This latter factor is, of course, the more important of the two and will be discussed in greater detail.

A ceramic planter is only functional when it adequately enhances the beauty while maintaining the life of a plant. To be physically practical, a planter must not be too tall for its width or be supported on too slender a base. It needs to be so balanced that when it is filled it will remain upright. This is especially important if the planter is to



The *Ficus benpamina* has rather large dark green leaves projecting gracefully from greyish white stems and trunk. Here it has been placed in a planter having a white rim which picks up and enhances the whiteness of the trunk and stems. This unit stands 4 feet high.

be placed on soft ground or a lawn. The planter must provide adequate drainage by having an opening at the bottom for water to drain through. The interior base of the planter should slope gently down towards the center to prevent the accumulation of any water which could cause the roots of the plant to rot. The foot ring should be high enough to prevent actual contact between the bottom inside base of the planter and the ground and to enable water to drain from the bottom opening. The foot ring should also be notched for the draining water to escape and to provide adequate circulation of air beneath the planter. The top diameter of a planter should usually exceed that of the base in order to insure simple removal of the plant at the time of transplanting without causing any damage. In conclusion, it can be safely said that the functional characteristics of a ceramic planter can only be determined successful or unsuccessful in relation to the health and beauty of the contained plant.

Aesthetically, a ceramic planter, by itself, is incomplete. It can be considered a complete unit only when containing a plant; in the same respect, a frame is only serving its purpose when bordering a picture or painting. The entire function and purpose of the planter is obviously to help the plant gain its maximum potential beauty. When a plant is contained in a planter it suddenly seems to acquire greater expressive and visual importance but only when it is displayed appropriately.

In the garden or patio the combination of plant and planter serves to add a splash of color and greenery while also creating contrasts to the already existing textural surfaces of the landscape and architecture. Some of the surfaces with which the ceramic planter must contrast and combine with are plaster, stone, cement, tile, synthetic materials, various meshes and weaves, trellises, rails and, of course, soil, water and vegetation. The planter's function, therefore, is to correlate some or all of these surfaces to form a harmonious and picturesque setting for the plant. Ceramic planters can really do this most successfully because of the clay material. Natural fired clay is very subtle and neutral, not to mention the fact, that it is an earthy material.

There are several practical aesthetic considerations which should be stated in terms of ceramic planters. The form of a planter should usually be uncomplicated and designed with a particular plant in mind. The visual lines of the planter should be simplified to the point where one's eye will be more attracted to the plant contained than to the planter. If the planter is to be straight or curved in outline, it should be moderate. The foot of the planter should be designed solely for supporting the planter and should remain inconspicuous in most cases. The exception to this would be to elevate a planter high above the ground by a high and perhaps showy foot or eliminating it completely by suspending it in the air. The top rim of the planter is one of the most important features mainly because one's eye will first see the top of the planter from any normal standing position. If the rim is too thin it will make the planter appear flimsy and fragile, and if too thick the plant will seem to be encased causing the planter to appear heavy, bulky and dominating. The rim should be designed to establish the ultimate separation between the plant and the pot by providing a subtle transition. The exterior surface of the planter can be smoothed and refined, lightly textured, heavily textured, inscribed, incised, carved or grooved. These various techniques may be used in combination with one another or separately. Once again, the plant to be contained, should determine this factor. From these general considerations set forth it can readily be seen that a ceramic planter can have many different shapes, form, color, and textures which gives the potter almost unlimited possibilities to work from in achieving attractive and functional planters.

The size and structure of a plant is another important factor when considering it for a ceramic planter. Plants may be monumental, medium or miniature in size and structurally, they can be classed into nine specific groups: bladed, softer bladed, branching,



This Mondo Grass, a member of the Ophiopogon family is an evergreen, sod-forming stemless narrow leaved plant. Being small and tidy it is a good pot specimen. This Mondo Grass is contained in a small rounded planter with a finely scratched textural surface imitating the hairy-like quality of the plant. The planter, in color, ranges from buff to a warm pink. This unit stands almost 10" high.



The Clivia, Kafir Lily of the *Amarillidaceae* family is a dark green wide-bladed plant having a flower ranging in color from scarlet to yellow. Being such a bold and dynamic plant it was placed in a huge planter having a deeply carved textural surface. The planter is light buff to brown with small and large grainy specks coming through the clay. The entire unit stands approximately three and one-half feet high.



This cascading type succulent, popularly known as Donkey Tail is ideal in a hanging or suspended planter such as this. It is a delicate light green color and here displayed in a hanging planter which is buff to pink in color with a white ringed opening from which the plant appears to burst forth. It is notched at the top and can hang from porches, balconies or any type of overhang. At the bottom of the planter have been included pinpoint size drain holes which function very well. This hanging planter is about seven inches high and five inches wide.



These Mexican White Pines are miniatures having very long and delicate needles radiating from the stems. The planters for these pines are also rather delicate in appearance having a straight slightly flared outline with a thickened top edge. They are lightly textured and dark brown in color which picks up the brown color of the needle tips. These units each stand about fifteen inches high.



The *Cupressus arizonica* is an attractive shrub with a distinctive grey-blue foliage contrasting with a warm copper-brown trunk and stems. The planter in which it is placed matches this coppery color of the trunk and branches while the textured surface suggests a subtle relationship to the delicate foliage. This unit stands three and one-half feet high.

cane, columnar, clumped, fern, hanging or cascading and rosette. The color and texture of the plant must also be considered as important factors in the final placement of the plant.

With today's emphasis upon outdoor living and increased leisure time it is readily understandable why gardening and landscaping play such a major role in many peoples' lives. This is, therefore, why the ceramic planter can and should play an important part towards the fulfillment of a beautiful garden, terrace or patio. Perhaps one of the most important reasons for this being possible is the actual ceramic material itself. Ceramic or clay material, is, as is well known, a naturally occurring, earthy material that can be moulded into almost any preconceived form while in the plastic state and then hardened by firing to retain a particular form forever. The advantages of this particular fact is that one does not have to be concerned that the planter will warp, crack, age, expand, mold, crumble or break, providing that it is not dropped or kicked over. Not only is a ceramic planter so practical but it is also so attractive. Natural, unglazed fired clay is a beautiful material due to the warm buffs and brown colors that can be achieved just through the action of the fire. Another reason why clay is such an ideal material for planters is that its primary function is to be used for the purpose of making vessels or containers. Primitive peoples were the first to realize this quality in clay and all cultures from earliest times up through the present have and are utilizing clay for container purposes. Today there are many synthetic materials that can take the place of clay for use as a container and which function, in many cases better than clay. However, for a planter clay is an ideal material because of its natural unrefined aspects which blend so beautifully with living and growing plants.

The photographs included here are examples of plants contained in ceramic planters produced from what is known as stoneware clay. This is a vitrious and high firing clay which is extremely strong and dense. The density properties of this clay are simply ideal for planters. Fired at maximum temperature (2300° F.) this clay becomes dense enough to maintain moisture over a reasonable period, a week or more, and yet still permit the circulation of air through the wall of the planter to keep the roots of the plant from suffocating. After watering a plant a stoneware ceramic planter will not sweat which automatically eliminates a build-up or residue of alkaline particles on the surface of the planter.

Each planter was created for the particular plant contained well in mind. In order to do this the physical characteristics, the color, texture and structure, of the plant were carefully studied. The planter was then made and the plant contained. In these examples the planter remains subordinate while enhancing the plant and creating a visually harmonious and exciting botanical display.

COVER PICTURE

Basic ornamentals of interest, *Raphiolepis umbellata ovata* and *Raphiolepis indica rosea* combine beauty with ease of culture and hardiness. Alfred Hottes whose excellent scratch board drawings illustrate these two varieties had this to say, "Give them water in the summer and plant them in the sun or with a little shade. They are slow to start but are long lived. Prune the plants each year to keep them small and compact if this is desired."

When is a Tree not a Tree

ED PUGH

Fantastic and unreal are often the words used when a person first sees the Ombu tree, botanically known as *Phytolacca dioica*. Tremendous elephantine roots bulge from the ground forming buttresses two feet high supporting a huge, grey trunk from which spring wide spreading branches reaching 60 feet into the air. Often featured in children's stories in the Argentine, the romantic Latin Americans call it "La bella sombra," the tree with the beautiful shadow. Yet, this tree is grouped with the herbaceous Pokeberry family.

It is true the wood is light and spongy which cuts like cheese exuding a horrible odor, but, like all plants on the face of the earth, it does have some beneficial assets. An old Creole-Spanish dictionary states the juice of the tree is medicinally valuable as a scab cure for sheep, and to treat drunkenness in man. It also describes the use of the berries in the removal of stains from clothing.

The Ombu grows at such an astonishing rate, it has been known to produce a trunk a foot and half through in three years. In its matured state, it stands about sixty feet high, with a spread of fifty to sixty feet. The leaves, elliptically shaped, eight to ten inches long, form a dense crown, which, in turn, become covered by small white flowers, and then a distinctive, flattish, berry-like fruit resembling fancy oval doughnuts. The tree is tender, losing leaf growth during freezes, but remaining uninjured.

It likes a well drained deep rich soil, and a somewhat protected location. It is quite easily propagated by seed or soft-wood cuttings. Since the roots of this tree lift and break sidewalks, its use is restricted to parks, botanic gardens or large estates as a shade or curiosity plant. Visitors to the Los Angeles State and County Arboretum in Arcadia should look for the Ombu just southwest of the bend in the road approach to the summit of Tallac Knoll. While this is still a young specimen, larger ones may be seen in the Huntington Gardens in San Marino, and in Verdugo Woodland Park, just north of the swimming pool by the Glendale Auditorium.

Many superstitions center around the Ombu, all of which have a special appeal for children. One of the most outstanding, on which many stories are based, states that when a traveller lies under the tree for a siesta, he hears footsteps, noises of dogs and fowls, of children shouting and laughing, people talking, but when he awakens and listens, the sounds disappear.

W. H. Hudson, the Anglo-Argentina naturalist, writes affectionately, in his book "*Tales of the Pampas*," of the house where he was born. The house was named "Los Viente-cinco Ombus," the twenty-five Ombu Trees. On the Pampas, standing wide apart in a row about four hundred yards long are the twenty-five Ombus, which he whimsically describes "like twenty-five enormous hormone treated kohlrabi plants." For lack of a better description, the Latin American expression comes to mind, "Porque no," why not? After all, it is not a tree.

Activities of a Taxonomist

LEONID ENARI

Ladies and Gentlemen:

I have been asked to write an article for this magazine, about my activities as Plant Taxonomist at the Los Angeles State and County Arboretum. In doing so, I also appreciate the opportunity to incorporate some of the problems related to my work.

The responsibilities of this office fall mainly into five categories: 1) Identification of plants growing at the Arboretum; 2) Research; 3) Identification of submitted plants and plant material; 4) Consultation; and 5) Teaching.

IDENTIFICATION OF PLANTS GROWING AT THE ARBORETUM

One of the main objectives of the Los Angeles State and County Arboretum is to introduce from all possible sources, especially from regions with similar climates, new or rare woody plants likely to succeed in the southern California area and to be of horticultural value.

There may be 250,000 species of vascular plants, not including the countless thousands of sub-species, varieties, sub-varieties, forms, sub-forms and cultivars. No botanist is capable of recognizing all 250,000. A well trained and experienced taxonomist will recognize a few thousands, probably not more than 5,000. For the rest, he depends on libraries and herbaria. He needs comparative studies to key out plants under question, comprehensive descriptions to confirm his determinations, references to the current botanical names of these plants and other names under which they may have been known.

The single work where he can find all that information does not exist and probably never will. All that information is scattered not in many, not in hundreds, but through thousands of books, magazines, and journals published in many languages over a period of many years, and not available in most institutional libraries, which also applies to our library. What makes the situation even more frustrating is that most of them are already long out of print or not reliable any more.

In dealing with limited floras or limited taxonomic groups, it is possible to become a specialist. Dealing with the plant population of the world, or should I say earth, it is completely impossible.

We are introducing plants practically from all parts of the world. Many of these are relatively well known and offer no problems. Others come from areas botanically less known and here is where the problems arise. According to my experience 5% if not 10% of the plants introduced, come to us misidentified or under names no longer valid. It is my responsibility to "discover" such misidentified plants and to correct their identification. Sometimes the results are completely surprising. Who ever suspected that the plant long known in California and sold in nurseries as *Viburnum japonicum* is not that species at all, but *Viburnum odoratissimum*, a completely different species. In many cases I still am not sure if the identifications of certain species are correct. For example, I am questioning even the identity of the name *Gardenia jasminoides*, which is applied to gardenias grown in the United States, but final determination must await more information. The material we sent to Kew, last year, for comparison with the authentic material in their herbarium has not come back yet.

We are sometimes criticized for not using the common names on our display labels, or for using only Latin names, or for changing the names of already well known plants.

The first complaint is not exactly correct. We use common names, even though it is

contrary to my personal belief, when they are known to exist in local usage. It is as meaningless, if not ridiculous, to use such names as Mgundaguluwe, Muparamhoswa, Nsiwi, or Umdhlonza on our labels as it is to use local California names such as Mickey Mouse plant, or Bird's-eye bush in Rhodesia. For your information they all apply to *Ochna serrulata*, previously known and still known in nursery trade as *Ochna multiflora*.

Latin is the only language which allows botanists and gardeners in all parts of the world to refer to specific plants without a chance of misunderstanding or ambiguity. Furthermore, there is only one valid name in Latin, while in English there may be numerous valid names. May I quote here a sentence from Alastair Simpson's article in the *Gardeners Chronicle*, 1959. Mr. Simpson visited Sochi, a Russian health resort and spa on the eastern shores of the Black Sea, and reported; "The Botanical Garden was the only place in Sochi where I did not feel at a loss, due to common language, i.e., Latin." . . . This is a perfect example of the value of Latin in plant nomenclature.

As for changing names, the international ruling is that the first-recorded name of a plant should, at all times, take precedence. This makes some changes inevitable. One of the recent name changes for example, was that of *Cydonia japonica* to *Chaenomeles speciosa*. In addition, for many years, American botanists were using two sets of rules — some followed the International Rules, while others followed the so-called American rules. This resulted and added even more confusion to the already existing problem of name standardization. The alterations in plant names by this office are made in accordance with the *International Code of Botanical Nomenclature* and the *International Code of Nomenclature for Cultivated Plants*.

RESEARCH

The existence and completeness of its living collections, library, and herbarium, general policy of the institution and available time, are all factors which determine the scope of taxonomic research at any arboretum or botanical garden.

Because of its limited budget, our library is far from being satisfactory even for routine work, and our herbarium, although rapidly growing thanks to the efforts of our curator, is still in its third year of infancy.

How time consuming is botanical research? I would like to mention here the experience of Australian botanists preparing their new Flora of Australia. They estimate that each taxonomist, working full time with adequate facilities, can deal with, on the average, not more than 80 species per year. If the flora is to be produced within about 20 years, 15 taxonomists will be the minimum number required for the vascular plants.

Considering all factors involved the only reasonable approach seems to be applied research, making a limited amount of taxonomic data available to the general public. Following this line, I prepared a manuscript, *Ornamental Shrubs of California*, which was published by the Ward Richie Press in association with the California Arboretum Foundation, Inc., in February, 1962.

The aim of this book is two-fold. First, to provide means of identification of ornamental shrubs grown in gardens, parks and nurseries of California, and second, to draw attention and stimulate research on the many taxonomic problems still outstanding. It is intended primarily for students, teachers, nurserymen, gardeners, landscape architects, home owners and amateur botanists who often find the standard manuals of plant identification too technical for easy use.

The key in this book is based on the more obvious features of shrubs, such as color of flowers, number of sepals, petals, stamens and pistils, and form and arrangement of leaves. To illustrate the use of the key, let us take the Mexican orange, *Choisya ternata* H.B.K., a rather well known shrub from Mexico with compound trifololate leaves and white flowers (if you already do not know the meaning of botanical terms, there is a glossary of botanical terms with illustrations in the book).

The key begins on page 27, where we, first time, must make one choice of two statements.

- 1A Leaves (or leaf-like organs) apparently absent. 2
- 1B Leaves (or leaf-like organs) present. 11
- We choose 1B and go on to 11
- 11A Leaves simple 12
- 11B Leaves compound 437
- We chose 11B and go on to 437
- 437A Leaves alternate 438
- 437B Leaves opposite or whorled. 472
- We choose 437B and go on to 472
- 472A Flowers yellow
- Primrose jasmin, *Jasminum mesnyi*, p. 157
- 472B Flowers not yellow. 473
- We choose 472B and go on to 473
- 473A Flowers white 474
- 473B Flowers lilac, lavender or violet. 477
- We choose 473A and go on to 474
- 474A Stamens 2
- Poet's jasmine, *Jasminum officinale*, p. 167
- 474B Stamens more than 2. 475
- We choose 474B and go on to 475
- 475A Stamens 4 477
- 465B Stamens more than 4. 476
- We choose 475B and go on to 476
- 467A Stamens 5
- Blue elder, *Sambucus caerulea*, p. 182
- 476B Stamens 10
- Mexican orange, *Choisya ternata*, p. 113

Here, at 476B, we recognize our plant. On page 113 we find a description of the Mexican Orange.

The botanical descriptions in the second part of the book have been prepared from living material growing in the Los Angeles State and County Arboretum and in other localities in California, after comparison with published descriptions in monographs, special papers, technical journals and floras. They are uniform, and in my opinion easy to compare. The entry for Chinese hibiscus will serve here as an example:

Chinese hibiscus. *Hibiscus rosa-sinensis* L.

An evergreen shrub or tree up to 15 (25) ft. Leaves simple, ovate, coarsely toothed, 3 to 5 in. long, alternate, petioled, glabrous or with few scattered hairs beneath, with stipules (Fig. 131). Flowers bright rose-red (in the type), 4 to 6 in. across, regular, bisexual, pediceled, in l's, axillary. Calyx of 5 united sepals, 5-cleft, with an involucre (epicalyx) of 6 or 7 linear bracts below. Corolla of 5 distinct petals. Stamens numerous, cohering into a tube about the pistil with the anthers at the apex, much longer than the corolla. Pistils (ovaries) 1. Fruit dry, a capsule. Native probably to China.

Runs into many forms with pale yellow, amber, white, pink, rose or red single, semi-double or double flowers.

The Chinese are said to make a black dye from the petals of this species for their shoes, hair and eyebrows.

After finishing the manuscript and turning it over to the publisher any author understandably is very much interested in the "finished product" and its degree of acceptance. The reviews of this book have been favorable, and the criticism when offered, suggestive.

and constructive. Even more, the book has been adopted already by several colleges and universities as a textbook.

The following are the excerpts from some of the reviews:

"Perhaps one of the most formidable undertakings of plant taxonomists is that of providing the gardening public comprising as it does all types of interests from the rankest amateur to the professional botanist, with a work equally usable by all. The amateur frets over complexities and the professional condemns omissions, but both are grateful for a work such as this to help them identify an unfamiliar plant.

"One of the advantages of having a plant taxonomist as the author of a work of this scope is in the matter of nomenclature, which in this book is strictly up-to-date and reliable, including the cultivar names.

"This book by Dr. Enari is a welcome effort in this time of the expanding field of gardening when people are more and more becoming aware of plants and are trying to learn their names." *Baileya*

"Gardeners and homeowners, nurserymen and landscape architects, students, teachers and amateur botanists will welcome this new guide to the shrubs of California.

"Equipped with this book even a beginner can successfully identify 277 shrubs grown in California." *Golden Gardens*

"The key requires flowers and leaves but is a comparatively simple one.

"The bulk of the book is given over to clear descriptions of each of the species, in technical, but relatively simple terms.

"Interesting and useful notes are appended to a number of the descriptions, particularly for those which are known to be dangerously poisonous." —*Missouri Botanical Garden Bulletin*

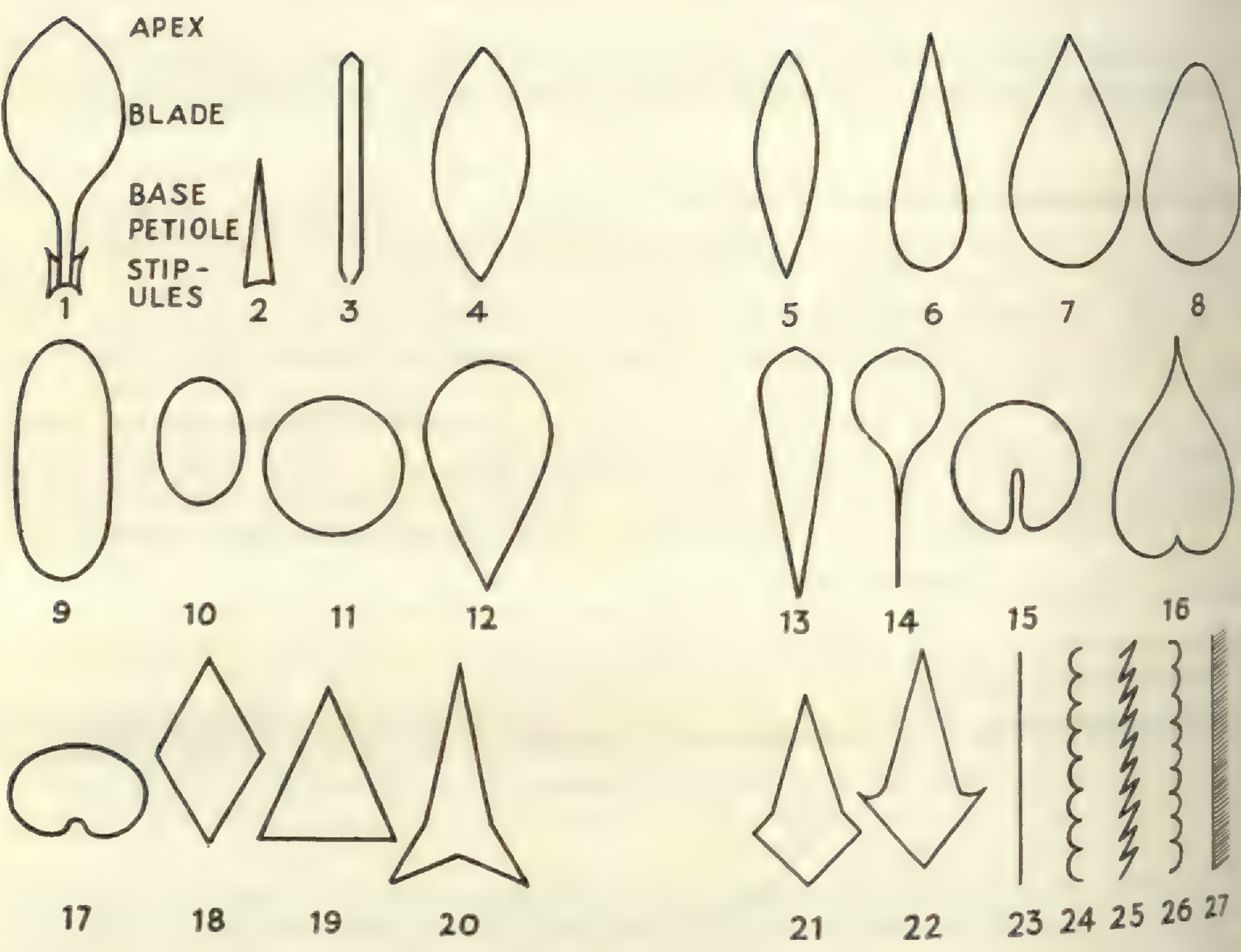
"Despite the fact that this is a book written specifically for California, over half of the species in it will grow in the Pacific Northwest so its usefulness is not limited to one state. It would be very desirable if this type of work could be expanded so as to give a broader coverage in plant material and geography." —*The University of Washington Arboretum Bulletin*

IDENTIFICATION OF SUBMITTED PLANTS AND PLANT MATERIAL

As a public service this office identified plant material brought or sent in by high school or college students, teachers, home owners, nurseries, law enforcement agencies, and the general public.

During the year, we identify hundreds of "specimens" consisting usually of a single leaf, at best. This is not always as simple as it seems. A leaf, particularly when it comes from an eucalyptus tree, a leaflet of a compound leaf, a dried flower, a seed or seed pod, a drawing of a deciduous tree, seen in wintertime in Nebraska, an artists' creation (particularly when the artist happens to be one of the admirer's of Picasso's expressionism), an artificial flower with the label "Made in Japan," a few leaves collected from the Venezuelan jungle (they still are on my desk) are not sufficient for positive identification. So, next time you send something to us to be identified, please send a specimen large enough to reveal what the plant is like and with leaves, flowers, and even with fruits, if possible. For doing this, please accept our gratitude in advance.

Only rarely can a plant be identified by a non-botanical description over the phone or in correspondence. I still remember one of the phone calls in my first year here I was asked to identify a weed with white flowers and green leaves, which was all I could get out of Miss or Mrs. X. But right she was, I know it, because next day she was in my office with her white-flowered, green-leaved weed. It was Sweet alyssum, *Alyssum maritimum*.



See opposite page for explanation.

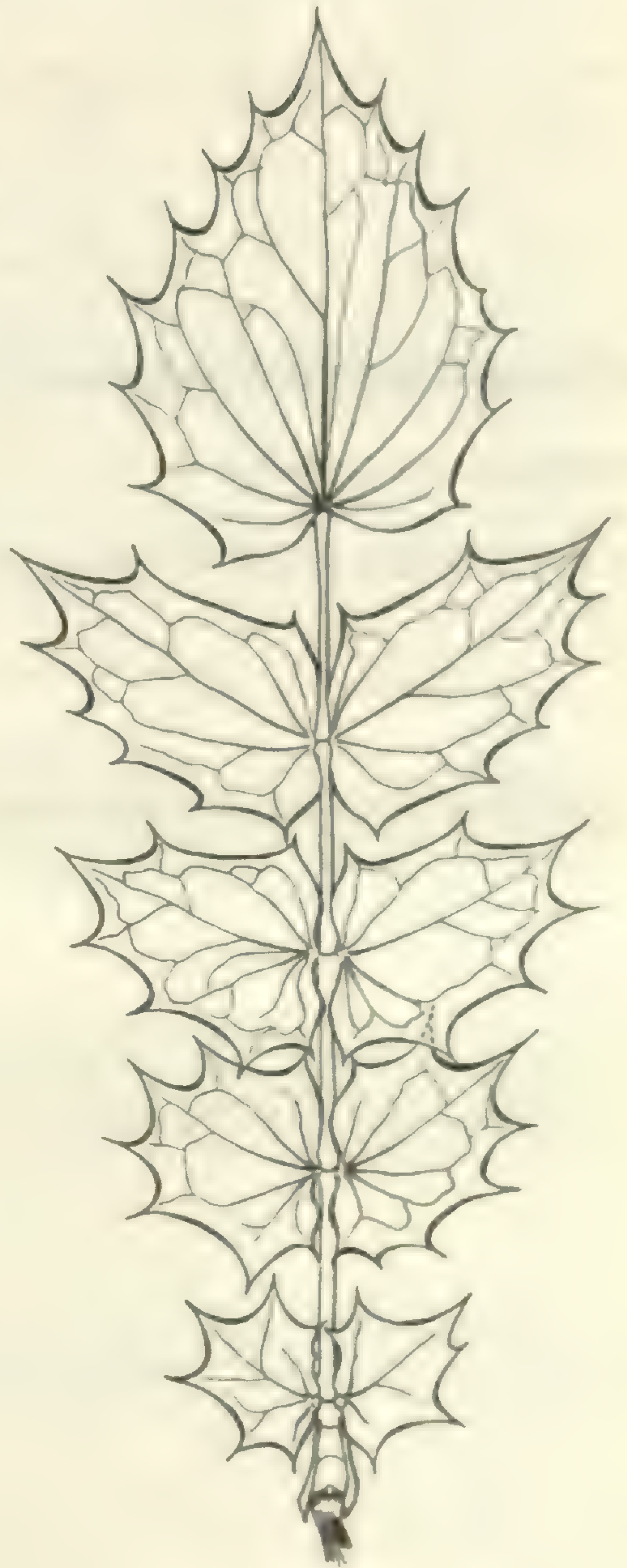
Sample of illustration from
Ornamental Shrubs of California

LEAF SHAPES:

1. Leaf with apex, blade, base, petiole and stipules
2. Awl-shaped
3. Linear
4. Elliptic
5. Narrowly elliptic
6. Lanceolate
7. Ovate
8. Ovate
9. Oblong
10. Oval
11. Orbicular
12. Obovate
13. Oblanceolate
14. Spatulate
15. Orbicular; cordate base
16. Cordiform
17. Reniform
18. Rhomboidal
19. Triangular
20. Sagittate
21. Hastate
22. Hastate

LEAF MARGINS:

23. Entire
24. Dentate
25. Serrate
26. Crenate
27. Ciliate



75. Leaf of Chinese mahonia,
Mahonia bealii.

CONSULTATION

This office is also available for consultation by other departments of the County, and the general public, on problems involved in the field of taxonomy. During the last year I have been consulted many times by the Los Angeles Sheriff's Department, Santa Monica Police Department and others involving plant material in criminal cases such as murder, rape, burglaries and narcotics. In the murder case I was able to prove that the half-digested fruits found in the stomach of a dead woman belonged to an extremely poisonous plant, *Digitalis purpurea*, commonly known as Foxglove.

In scientific work it is essential that we apply names with precisions, for the validity of much research hinges on the identification of the material involved. So it is not surprising that our other biologists on the staff occasionally consult with this office.

Many times this office has been consulted by the local physicians, hospitals and particularly by worried parents involving a poisonous plant eaten by children.

Many problems, such as: How to make poison oak not toxic, how to feed parakeets, how to get rid of neighborhood cats by using poisonous plants, how to smuggle plants into California without a permit, how to get rid of an old Rice paper plant in the neighbor's back yard that is sending suckers into your yard, and numerous others referred to this office do not seem to belong within the scope of plant taxonomy, at least not according to the second edition of Webster's Dictionary. In talking about the Rice paper plant incident in one of my evening classes I am teaching, the reaction was rather amusing: "Well, *how* do you do it?"

Recently, I also served as consultant and botanical authority for the Los Angeles County Flood Control District and the County Counsel. During court proceedings I was able to prove that an allegedly rare eucalyptus was really a typical and common *Eucalyptus pulverulenta*, which consistently flowers and fruits in this area and of which seeds are readily available commercially.

The following are excerpts from the letter of the County Counsel dated September 5, 1962:

"I wish to express on behalf of this office and of the Flood Control District our sincere thanks for the valuable assistance that you rendered to us in the recent trial involving the acquisition of a portion of a grove of *Eucalyptus pulverulenta* trees. Judgement was rendered by the court in that matter on August 29, 1962, and I consider the judgement to be most favorable to the Flood Control District."

"Please accept my apologies for any personal inconvenience suffered by you as a result of appearing as a witness on behalf of the District, as I believe you are aware the defendants in that action had a claim, the sum exceeding \$500,000.00. Final judgement by the court was in the sum of \$85,740.00 which represented a considerable savings to the District and the taxpayers of this County."

"Thank you again for your fine cooperation and valuable assistance."

TEACHING

Under the sponsorship of the Arcadia Unified School District's Adult Education Program, I am teaching Plant Identification. The students in this 14-week evening course learn how to identify plants, both native and exotic, through use of a botanical vocabulary and plant "keys." It is expected that after finishing the course they should be familiar with 150 to 200 plants and able to recognize them regardless of where they grow.

If the popularity of a course can be judged from its attendance and letters expressing appreciation, I would say this course has proved to be popular. This year the course has been extended another 14 weeks at a more advanced level.

In addition to the course mentioned above I am teaching an evening course in Plant Chemistry and a day time class in Plant Identification in our Professional Gardener's School.

The Aesthetic and Recreational Values in Botanical Gardens

ELIZABETH ANN MOREL

Part 5

Parts 1, 2, 3 and 4 were published in Lasca Leaves, Vol. XII, 1962

RECREATIONAL VALUES

Widely different meanings are attributed to the word *recreation*, as it is applied to a great variety of activities. Because of these differences, it is desirable to indicate what is meant by recreation, passive and potential as these differ from other types.

Recreation is commonly referred to as "a type of experience, a form of activity, as an area of rich and abundant living . . . as an expression of the inner nature of man, or a phase of the total educational process . . ." Hence, in some ways it relates to the botanic garden purpose. Here, in this work, the term *recreation* will not be used to refer to forms of competitive sport or games, nor will it include such activities as picnicking. Both Charles Eliot and Frederick Law Olmsted recognized that the supreme functional use of garden or park areas of this type, for the recreation of the people, must be "of a passive and semi-active kind, the dominant ideal being peaceful enjoyment amid beautiful surroundings of a naturalistic kind."

Among the needs for satisfying enjoyment of life are cited "beauty, knowlege, and ideals." The botanic garden holds its place of importance in modern life because among other things it has afforded and continues to afford opportunities for the attainment of these basic human needs. The enjoyment of a visitation to a botanical garden is enhanced by the fact that "satisfaction may be derived almost as much from the memory of the experience in the garden as from the actual visitation itself."

The satisfactions to be attained as having recreational value, at a botanic garden, are in the use of one's mental powers, enjoyment of one's physical existence, emotional stimulation, the freedom of creativity (in self or others), a sense of adventure, even of achievement, relaxation, fellowship with others of like mind, and appreciation of beauty. Because individuals find that certain activities yield one or more of these satisfactions, the activities become recreation. However, different people seek and find different kinds of pleasurable experiences in a botanic garden. Furthermore, a single form of activity may yield several types of satisfaction to the same individual. Hence it may be said that the recreational value of an activity for a particular person depends upon the way in which he is affected by it and upon the richness of the experience which it affords him.

The persisting desire on the part of man to extend his knowledge and to gain new experience makes for continued growth and progress. Many forms of recreation owe their appeal to the fact that they contribute to this universal human desire. Especially is this true of nature activities, which afford unlimited opportunities for exploring the wonders of the world about us. Man's curiosity and his desire for new experience explain in part the popularity of travel. For this reason, those parts of a garden devoted to geographical organization, where plants are grouped by reason of similar geographical origin, may offer satisfaction through imagination or imagery, in the feeling that this situation is similar to a given foreign one. The occasional surprise feature, an experimental project, or sponsorship of an untried activity may yield an added element of satisfaction.

Because of the common association of mental effort and work, the relationship of recreation to the exercise of one's mental powers may not be immediately apparent. Yet man engages in many forms of recreation primarily because they offer a stimulation to

mental activity. "Interest in an activity is likely to lag when it no longer makes demands upon the mental powers of the participant." Thus the mental stimulation imparted by a botanic garden, the learning and studying of the many facets of available information, accounts for much of their extensive appeal.

The basic relationship between senses and satisfactions is so obvious as to require little comment. Harry A. Overstreet has probably made the most important point in this regard with his statement that "The more senses we lend to an experience, the more vivid and rich it . . . then . . . becomes."

The significant part which emotional response plays in the recreative appeal of the botanic garden depends largely upon the character of the landscape design and the effectiveness of treatment of the land, the spaces, the total composition, and consequently upon the entire effect gained. An activity is not likely to become a form of recreation unless participation in it brings a favorable emotional response in the person. Because, then, of the multitudinous potentialities of creation with plant forms, the emotional satisfactions which are sought and achieved through visitation to a botanic garden can be as varied in quality and scope as humanity itself.

Man is said to crave some area in his life where he can excel, can feel a sense of achievement. Because many people fail to get this kind of satisfaction in their work, they seek it in recreation. Some people are able to attain it by raising their own standard of performance rather than by surpassing others, in competition. Thus anyone may gain that satisfaction which results from making progress, from increasing his skill in some activity. A part of the fascination involved is in the opportunity offered for the utilization of existing skills and in their challenge to greater attainment. In the true and full meaning of these terms, then, the sense of adventure and the sense of achievement can be said to be very close if not indeed almost inseparable. Both may be exercised in experiencing what a botanic garden has to offer.

Certainly, relaxation and rest and repose are in themselves definite forms of recreation. Enhanced by reflection and contemplation, these may be indeed creative. They are potential forms of recreation to be found in a botanic garden, just as they may be found in any area of scenic beauty or grandeur. They may be enjoyed in solitude, sometimes thought to be essential for fullest enjoyment. At the same time, many of the other forms of recreational activity and value found herein, which yield their greatest satisfactions when engaged in by a group, are also available for participation and enjoyment.

Fellowship and shared interest are found in the visitations to a botanic garden, thus ministering directly to man's need for companionship, social relationships, and cooperative activity. Here people are gathered in an atmosphere of friendliness which pervades because of an underlying relationship of similar interests. Each person, consequently, may identify with the other visitors and feel himself to be a part of the total operation and process.

Valuable recreational and cultural services are offered by many present day botanic gardens. Among these, the following examples may be of interest. Afternoon and evening concerts and other musical productions by outstanding artists are apparently much enjoyed. While this feature is more often found in gardens abroad than in the United States, there seems no doubt it is highly valued. At the botanic garden in Melbourne, Australia, musical functions "never fail to appeal, . . . and are never subjected to criticism." In recent years, the performances in this garden of open air orchestral and vocal concerts, under the title of "Music for the People," are said to have met with outstanding public approval; "music in the atmosphere of the Botanic Gardens on a sunny afternoon is a sheer delight." Official estimates of attendance on a single Sunday when a performance was scheduled have exceeded 120,000. The Waterfall Botanical Gardens of Penang are known as another institution providing musical programs at specified occasions during the year.

(To be continued)

This is the complete bibliography from Miss Morel's thesis.

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Viburnum Rufidulum

ROSS GOODRICH

In Southern California there are not many plants whose leaves turn red in the fall — red enough, that is, to be called a good show of fall color. Many partly turn, or color up one year and not the next.

In the collection of North American deciduous trees and shrubs in the Arboretum there is a small (6' tall) Southern Black-Haw, *Viburnum rufidulum*, that has turned red each of the past several years. In November, long after hope has gone that the leaves will again change color before dropping, the first touches of red have shown up. Then the oval, finely toothed leaves turn slowly, staying red for nearly a month, hanging on through the leaf dropping of other deciduous shrubs and trees around it.

Through the spring and summer this shrub is attractive but not spectacular. Its branch structure makes it graceful and dignified but it is as unobtrusive as a quiet neighbor. It has been slow growing. Six years in the Arboretum and it is only six feet tall and six across.

In its native eastern United States the plant gets much taller. This particular one has been in part shade, a meaningless statement unless defined a bit. In this case it means under a large deciduous tree but with a little open sky to the side. This position could have slowed its growth and possibly added to its holding on to its color for so long a period. In the care of this plant no special treatment has been given. Annual feeding, no pruning, and possibly a little less water than it should have had to make it look its best through the summers.

In the east, growing wild, these plants turn red quickly, shed quickly, so the luck with this particular one may be a fluke. Trying more of them in other spots will test this out.



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"Plants Have Diseases Too"

JAMES P. MARTIN, JR.

The work of the plant pathologist at the Los Angeles State and County Arboretum may be best described by discussing separately the various roles he assumes. Often, he is an extension specialist, at other times, a research investigator, and on occasion, teacher. Actually, to separate these responsibilities except for convenience in discussion is unnecessary and difficult since each is so closely related to the other.

Invariably, whether the inquiry is from the professional staff at the Arboretum or from the remaining citizenry of Los Angeles and surrounding counties, the pathologist is greeted with the following two questions: "What is it?" followed quickly by "What should I do about it?". Of course, the questions are based on the assumption that the plant or plants in question are atypical in some respect or in other words, there has

been interference, in some way, with their normal development.

Such plants may be pale green or even yellow by comparison with the normal thus we would say that they are chlorotic. Or perhaps, definite lesions are present on the vegetative or floral parts. Wilting of a portion or all of the plant may have occurred. Again, plant parts may have become dwarfed or enlarged or in some other way malformed. Rotting is apparent by the dark brown of dead cells which are often foul smelling.

The same symptoms which instigated the inquiry of the pathologist may aid him initially to categorize the problem.

Before the extension specialist initiates his inquiry into the nature of the problem, he would like as much information as possible from the grower concerning nomenclature, degree of severity, extent of garden area involved, cropping history, weather and soil conditions, fertilization, watering practices, and pest control measures utilized.

In addition, to furnishing as much of the above information as is possible regarding the suspect plants, one should bring or send to the pathologist examples which show typical symptoms preferably several samples showing different stages in disease development. When possible, the entire plant should be included. In general, avoid fleshy fruit in advanced stages of decay. Plant materials are best shipped in sealed plastic bags or other types of moisture proof containers. Do not add water. Large specimens may be cut into sections, and the roots wrapped separately in paper or bag to avoid getting soil on the other plant parts. Sealed plastic bags should be used always when soil samples containing nematodes are included. Specimens should be enclosed in a crush-proof carton or mailing tube with a return address.

In the United States, plant diseases brought about by insects belong in the field of economic entomology; therefore, when initial examination of a plant specimen indicates that the incitant may be an insect, the staff entomologist is consulted. Close cooperation between these two disciplines is essential because correct interpretation of the symptom expression often rests upon direct or indirect evidence of the presence of a given organism supplied only by a specialist.

The plant diseases which are the concern of the phytopathologist may be grouped for convenience into three classes. The first, is non-parasitic, that is diseases incited primarily by products of plant metabolism, soil conditions, meteorologic conditions, agricultural practices, or industrial by-products. In determining which of these factors represent the casual agent for a given disease, the pathologist relies on the close cooperation of specialists in a number of fields: plant physiology; soil science; horticulture; taxonomy; biochemistry, and meteorology. The second class, is parasitic, that is those diseases incited by algae, bacteria, fungi, phanerogams, and certain animal parasites, for example nematodes. The third class, is virus diseases. Certain authorities might place virus diseases in either of the previous two categories.

Fortunately for the plant pathologist many of the problems which fall into the above mentioned classifications have been described in regard to one or more plant species and catalogued by both his predecessors and his contemporaries. This information is available in the literature concerning disease problems, and should be close at hand as a ready reference. Certainly, a part of this literature would be meaningful to the public, and should be used whenever possible.

An example of one of these important tools, which is of particular interest to a pathologist, is the United States Department of Agriculture, Handbook #165, Index of Plant Diseases in the United States.

A careful examination of the plant or plants in question, and a comparison when possible with the description of a similarly appearing disease may suffice to determine the probable nature of the problem. However, unless concrete evidence is present for example a characteristic symptom combined with the presence of the organism known to cause the disease expression, positive identification awaits the replicated reproduction of the problem as a result of a given causal complex, or number of factors. Once the nature of the problem is determined, it remains to furnish whatever control measures are feasible whether curative or preventive.

Constant effort by all members of the professional staff is needed to maintain satisfactory plantings at the Arboretum. The pathologist contributes by supplying information designed to prevent plant disease, by diagnosing when possible the nature of exist-



Honey colored mushrooms, the fruiting body of the oak root fungus, *Armillaria mellea*. The host tree is the California pepper, *Schinus molle*. Photo: Denis Kucera

ing disease, and furnishing appropriate disease control recommendations. In addition to offering suggestions concerning preventative measures, such as soil sterilization, the pathologist may plan a seed treatment program or suggest a preventative spray schedule to avoid fungus disease in such varied items as turf grasses, roses, or perhaps sycamores. Again, a suggestion may be made for a fungicide drench to inhibit the spread of a disease in an existing plant bed, or information may be given concerning a fumigant such as "Vapam" which may be used to sterilize the soil in a garden area prior to planting or to prevent further problems in an area where disease has occurred.

Prerequisite to satisfactory control recommendations is the correct diagnosis of the diseases occurring on the grounds. Requests for identification of the casual agent involved in a given disease may come from the plant propagator who may be having a problem with damping off of seedlings in the greenhouse, the Arboretum gardener who may be losing plants in a particular location in the field, or the orchid specialist who may need help to determine the nature of leaf lesions on his plants.

Periodic inspections of the shrubs and trees on the Arboretum grounds by the staff pathologist enables early recognition of diseased conditions thus often avoiding further loss. For example, the close examination of a single diseased palm may show that it is being destroyed by the fungus, *Penicillium vermoeseni* Biourge. Prompt removal of this source of inoculum may avoid further loss among surrounding palms. Again, determining the extent of root rot in an oak may be helpful in making the decision either to remove portions of the tree to prolong its life or to destroy it.

The Arboretum gardeners keep a record of the reasons why plants are removed from their respective sections. When disease is involved, the pathologist is asked to determine the probable cause of death.

In addition to the plant diseases which have been described in the literature and for which control measures have been worked out, there are those which exist without satisfactory remedy. For some of these no control is known and for others existing controls need improvement. Periodically new problems arise which require research to establish their nature and possible control. It is for these reasons, primarily, the pathologist becomes investigator.

For example, currently at the Arboretum, the emphasis in plant disease research involves the problem of the oak root fungus, *Armillaria mellea* (Vohl.) Quel., particularly from the standpoint of effecting a more satisfactory control in ornamental plantings. This very destructive disease is not limited to oaks. Most ornamental trees, shrubs, and herbaceous plants are affected. Even weeds may become a host.

Early symptoms of this disease are similar to those caused by any root disturbance whether brought about by living organisms or not. A general dying back of the branches occurs, particularly from the tips. In some plants, oaks for example, the bark becomes cracked. In some other plants such as pines, acacias, etc., gumming near the base of the tree may be seen. Usually during the months of December through February, depending upon the season, the fruiting body of the fungus, a honey colored mushroom appears around the base of diseased trees, or growing on the roots of dead plants. These fleshy mushrooms are found in clusters and their size and shape varies somewhat depending upon their environment. Often, a ring shaped structure, annulus, is seen on the stem; and the white colored gills from which basidiospores are discharged are attached to the stem. The spores are air-borne and may initiate saprophytic development on dead plant parts. Between the bark and the wood, in diseased trees, a characteristic white to cream-colored mycelial mat develops. It is the vegetative stage of the fungus, and is rather

tough in consistency. Often, the mycelium appears to grow in a fan shaped pattern. The fungus and the associated plant tissue usually has a rather pronounced mushroom odor. Certain plants, particularly Engleman oak, have white tissues present in the bark which may be confused with the mycelium. In addition the fungus has a mycelial structure, the rhizomorph, which is resistant to adverse environmental conditions and may be seen on diseased roots or under the bark of trees which have been diseased for some time. Rhizomorphs appear as black strings with a white interior, and have a diameter approximately equal to that of a pencil lead. These structures are the means by which the fungus grows through the soil from one plant to another. The rhizomorphs become attached to the host, at least in part, by the hardening of a resin-like substance. The mycelium penetrates the outer cells of the root and growth continues, unless the host is resistant, until the lower portion of the tree trunk is completely girdled. Once this has occurred, movement of food downward from the leaves to the roots ceases and the tree ultimately die. Evidently, in some trees, not all of the tissue is affected, because the plant remains alive even though the fungus has completely girdled the trunk.

Because the oak root fungus lives both as a parasite in living tissue, and as a saprophyte in dead plant material, it is necessary not only to destroy diseased plants, but also to remove non-living host tissue or destroy the fungus within the dead plants. By 1894, partial sterilization of the soil with the soil fumigant, carbon disulfide, was tried in Europe, in an effort to destroy the saprophytic stage of the fungus. As early as 1914, in California, efforts were made to eradicate this fungus using fumigants. Since that time, much effort has been expended to find better fungicidal materials and means of application. Recent work at the University of California at Riverside, California has shown that methyl bromide at the rate of two pounds per one-hundred square feet of soil will kill the fungus in blocks of citrus roots, 2 to 3 inches in diameter, at a depth of five feet under optimum conditions for the diffusion of the gas. Unfortunately this fumigant, as well as others, has the disadvantage that it will kill the roots of all living plants. Thus, as is often the case for the homeowner, in areas where diseased roots are intermingled with the root systems of living plants, treatment with a fumigant is not feasible. When the disease has not progressed too far, it is often possible with trees and shrubs having a single basal stem, to prolong life by removal of the diseased tissue followed by an application of wound dressing. Another measure, the exposure of the roots adjacent to the trunk, seems to slow the movement of the fungus into the crown. Proper fertilization and supplemental watering as needed will help maintain the tree in good condition and increase disease resistance. When watering, one should avoid wetting the base of the trunk, and always apply the water in the root zone.

Seemingly, the most satisfactory control would be the introduction of oak root fungus resistant plants, those which have some structural or physiological characteristics which prevent successful invasion by the parasite.

The University of California has published a revised list of plants tested at San Jose, California, which were found to be resistant or susceptible to *Armillaria* root rot. Unfortunately some of the plants listed as immune or highly resistant at that location have been found to be quite susceptible in southern California. Consequently, a program has been initiated by the Arboretum to screen, under local conditions, selected ornamental trees, shrubs, and herbs, which would be of particular interest in southern California.

In 1961, two field plots were established, the first at Descanso Gardens in La Canada, California, and the other at the Lux Arboretum in Monrovia, California. Over three-hundred plants are under test at these locations. Sixty ornamental species are represented.

Thus far, twenty-two plants have become diseased. These represent five genera; *Brassia*, *Cassia*, *Euphorbia*, *Geranium*, and *Pinus*. Efforts are being made to screen additional species in the greenhouse.

Another approach to the control of oak root rot in living plants may be the use of systemic fungicides, that is, those which spread through a plant internally. At present, these materials are available in very limited numbers. Some of the antibiotic materials, such as Agrimycin, Griseofolvin, etc., have been used successfully in the control of certain bacterial and fungal diseases in plants. It is hoped that these or similar materials may be useful in the control of *Armillaria mellea* (Vohl.) Quel. Investigations to determine suitable plants for screening these materials are in progress.

The third and a very rewarding contribution which the pathologist makes is to offer, through education, some understanding of the nature of plant disease, its numerous causes, and the methods employed to control plant diseases.

Information is being offered to various groups at different times. Currently, the professional gardening staff is receiving a series of monthly lectures to better acquaint them with the various aspects of the disease problems which they are constantly observing in the field.

The annual curriculum of the Professional Gardener's School which is held at the Arboretum, includes thirty hours of class work in plant pathology.

An adult education program, sponsored by the Arcadia Unified School District, is being offered to the citizens of the surrounding area. As a part of this program, a series of fourteen lectures is being given in the study of plant diseases. In addition to the above series of lectures, a limited number of lectures are presented for special interest groups who require such information as a background for the performance of their professional duties.

In all of these lectures, within the limits of the time allowed, specific examples are used to point out the various problems due to animate and inanimate causes. Illustrations, as well as diseased plant material augment discussion to assist the student in recognition and study of various plant diseases. Crown gall of roses, fire blight of pyracantha, and other diseases illustrate clearly how much damage is done by bacteria. Various fungi responsible for plant injury are examined both from the standpoint of individual characteristics as well as their role in disease development. A number of important fungus diseases such as root and stem rots, wilts, and blights found in California and elsewhere are described. Information concerning the many plant diseases caused by viruses and nematodes is an important part of the course. Attention is given to many of the non-parasitic problems, including heat damage, inadequate soil mixture, air pollution, wind damage, and nutrient deficiencies. The importance of resistant varieties in plant disease control is explained along with a discussion of cultural and chemical control measures being used today. Throughout the lectures, additional sources of information are furnished.

The pathologist's duties at the Arboretum are varied and extremely interesting. All are direct responses to the challenge inherent in gaining a better understanding of the nature and control of plant disease, and making this knowledge useful to all.

Plant Pathologist

California Arboretum Foundation Gifts

Early in 1962, Mrs. William Warren Orcutt gave to the California Arboretum Foundation three historically significant items. They were: a handcrafted wooden Madonna, a stone baptismal font and a metate.

The Autumn, 1962 issue of *Lasca Leaves* carried a short article about these gifts. A picture of the Madonna was included; however, a black and white photograph cannot capture the real beauty of this gift.

Recently, Mrs. Orcutt sent the Foundation, additional information about each of these three historical pieces. We have taken the liberty of publishing this information as direct quotations from her letter:

"The Madonna was obtained by my husband, the late W. W. Orcutt, in Trondheim, the ancient capitol of Norway in 1925. At that time it was stated, and its appearance verified the statement, that the Madonna was a relic from a Norwegian Catholic church which antedated the time of Martin Luther, circes 1500 A.D. The frame was supplied in California.

"The lime-kilns, which were operated by the Mission Fathers in the 1790's to furnish lime in the building of the San Fernando Mission, were located in the west San Fernando Valley, where lime-stone was available. (This is in reference to the five stones comprising the base of the font. Ed.)

"The 'stone bowl' was said by the Smithsonian Institution, who desired its possession, to be the largest known Amerind artifact. Natives of the Lompoc area in Santa Barbara County, California, descendants of the early Spanish settlers, assured my husband, that by tradition the 'bowl' was undoubtedly the baptismal font, buried for preservation, following the destruction of the La Purissima Mission by earthquake in 1820.

"The 'metate' of fine workmanship, was originally the personal property of the Chief of the Matilija Indians in Ventura County, California, and was given by him to an early settler in the Ojai Valley. Later, it was presented to my brother-in-law, the late Alton L. Drown, formerly mayor of Ojai, and by him to the late William W. Orcutt, a petroleum geologist by profession, (the original discoverer of the La Brea fossil beds) and, also, an archeologist.

"The artifacts were donated by me to the Los Angeles State and County Arboretum in memory of the late William Warren Orcutt, for safekeeping, rather than to the Smithsonian Institution that desired them, because I considered them to be a part of the 'California Heritage,' and therefore should be preserved for posterity in their homeland."

Mary Logan Orcutt
(Mrs. William Warren Orcutt)

The Daimio Oak

Quercus Dentata

ROSS GOODRICH

The Daimio oak, as represented by a specimen at the Los Angeles State and County Arboretum, is a beautiful and interesting tree, though its appeal may be limited for use in this area.

It gets some notice because it stands almost by itself on the bank of the upper lagoon, some because oaks are generally attractive, but most because its leaves are so big. They have been large since the tree was planteed in 1953.

Though this Daimio (or Daymio) oak, *Quercus dentata*, is known for having the largest leaves of any oak, it was still a surprise to see a spindly little framework of branches hold such big leaves. Their color is the light green usually associated with the first burst of spring growth, and they have stayed the same until late in the summer with only a little darkening. Most of them have burned at the edges during the hot weather, our climate being too dry for such lush growth or possibly the soil is unfavorable, and one year the leaves stunted when the largest were scarcely a foot long.

A couple of years there has been a touch of red in the leaves towards autumn, but for the most part they have just turned a tobacco brown and hung on and on. For a few weeks this can be attractive, especially with the sun behind them, or towards sunset when they pick up an orange colored glow. But for most of us by this time it is like waiting for the other shoe to fall, and it would be nice to have them drop and get it over with.

In Asia its native distribution is from Manchuria and Mongolia through the central provinces of China to Yunnan. It is grown in Japan as an ornamental, as a silkworm tree, and its bark is used there for tanning. Aside from this the outside world has planted it sparingly. A few specimens are in scattered locations, mainly botanic gardens and arboreta in Europe and America.

Arboretum Gardener

Asiatic-Pacific Section



Quercus dentata, summer aspect. The tree was planted in the Asiatic-Pacific Section in 1953.
Photo: Denis Kucera



Quercus dentata, winter aspect.

Photo: L. B. Martin

The Tulip and the Netherlands

F. A. STAFLEU

The tulip has played an important role in Dutch horticulture almost since the beginning of its introduction in Western Europe. This role has been a different one in different times. It is a far cry from the growing of single specimens at fancy prices in the beginning of the 17th century to the mass production of tulips now in the bulb fields of Holland. Just as there is a wide gap between the use made by an unenlightened Antwerp merchant in the 16th century who received a quantity of bulbs from Turkey and found them definitely inferior to onions, and the distaste with which many Dutchmen turned to eating tulip bulbs again in the winter of 1944-1945.

The introduction of the tulip in Western Europe in the course of the 16th century is not something that came about by pure chance. Feudal Europe and medieval man were barely interested in flowers for their own sake or for the sake of beauty, and what, after all, is interest in flowers for the sake of beauty but horticulture, and what else but botany is interest in flowers for their own sake? Horticulture and botany in the modern sense of the words hardly existed in medieval times. Plants were grown for ornamental purposes mainly in the gardens of castles and cloisters; the medieval rose gardens are often mentioned in the literature and can be seen on a number of paintings. Mostly, however, plants were grown in gardens as herbs or for medicinal purposes, in a purely pragmatic way.

The number of plants grown in European gardens had remained constant for ages. The gardens contained mainly plants from southern and middle Europe with some plants of Asiatic origin, already introduced in classical times. Fragrant herbs and shrubs (roses!) were common, there were some daisies, lilies, periwinkles, aquilegias, peonies, carnations, iris, and violets, but of only a few of these species can one say that horticultural improvement had started and we should realize that they were always grown as individual plants, never in massive groups for display. There were hardly any hyacinths, daffodils, and snowdrops, and there were no lilacs, crocuses (except of course for the true saffron), tulips, anemones. The Dutch historian of horticulture, W. Van Dijk (1951), estimates the number of species generally grown in gardens at the beginning of the sixteenth century at about ninety. There were at least three hundred species in common cultivation by the end of the century. It was the renaissance that liberated and developed the culture of the individual mind and that brought about an open-minded attitude towards other human beings, and towards animals and plants.

The sixteenth century, therefore, saw at last the great development of gardens in Western Europe purely for ornamental purposes and the beginning of interest in plant species as objects of interest by themselves. This new attitude stimulated the introduction into Western Europe of new and unknown plants from foreign countries. A man like Carolus Clusius, [1526-1609] and his contemporaries, began to write botanical books for the sake of the knowledge and love of the plants themselves and not for the sake of their medical uses. The spectacular entry of the tulip into Western European gardens must be seen against this receptive spirit of the sixteenth century, receptive both from a botanical and from a horticultural point of view.

The pre-sixteenth century botanical or medico-botanical literature does not mention the tulip. None of the classical books mentions anything that can be taken for a tulip. The introduction of the tulip in the sixteenth century was due to the very close political and economic relations that developed in those times between Turkey, the Ottoman Empire, on the one hand and Austria, the Austrian Empire, on the other. In the middle of this century the Ottoman empire reached the peak of its economic and political growth. Turkey was one of the world-powers of the time. Moreover, it was a non-Christian, an Islamic nation, and very aggressively so. The Turkish menace hung heavily over West-

ern Europe, and the major European opponent of Turkey was at that time the enormous Austrian Empire. There were frequent wars and the Austrian power-line moved over the Balkan peninsula and the Danubian countries with the issues of those wars. On the other hand there was not always war: there were also times of peaceful coexistence in which intense and close economic and diplomatic contacts were maintained between the two powers. We have to thank those economic and diplomatic contacts between Austria and Turkey for the introduction of the tulip into Western Europe.

In the year 1554, Ogier Ghislain de Busbecq [1522-1592], a Flemish nobleman who was Austrian ambassador to Suleiman I, 'the Magnificent' [1494-1566], observed while traveling from Adrianople to Constantinople an abundance of flowers in the early spring when he still expected to see the dead landscape of winter. He mentions narcissus and hyacinths, and flowers which, he said were called '*tulipam*' by the Turks, and he comments on the great variety and the beauty of the colors of these flowers. The origin of the word tulip is still shrouded in mystery because the Turkish and Persian word for the flower is 'lale' and it is supposed by some that de Busbecq misunderstood his local servants or his interpreter who may have compared the shape of the flower to that of a turban or 'dulban'.

De Busbecq sent bulbs and seeds to Vienna, or perhaps he brought them there himself. It is not necessary to follow in detail the introduction: in the middle of the century and especially in the 1560's we come across several references to the tulip in contemporary literature. The Antwerp merchant who received this shipment of unknown bulbs from Turkey in 1562 has already been mentioned. The Netherlands were part of the Austrian empire at that time. He threw away the lot which he had not tried to consume and some of them produced flowers next spring: this is why it is known what the man had in hand.

In 1561 Konrad Gesner [1516-1565] was the first to describe and figure the tulip in a botanical publication; other figures are given by Pierandrea Mattioli [1500-1577] in 1565 in the Latin edition of his commentaries on Dioscorides (fig. 1) and by Carolus Clusius in 1576 (fig. 2).

The tulip was not the only horticultural plant of major importance brought to Western Europe from the Near East in the latter part of the sixteenth century. The growing interest in plants as such and as objects of beauty resulted in a kind of horticultural explosion, of which the many-colored tulips were part, but of which other examples are the yellow crocus, the tall bearded irises, the lilacs, the horse-chestnut, and many others.

From the fact that the tulip in its countries of origin, Turkey and Persia, already showed such great variety in the sixteenth century we may conclude that they had already been in cultivation for some time and that considerable hybridization had taken place. It is impossible now to trace the ancestors of our common tulips; in the sixteenth century these ancestors must have already become obscure. Almost all our common garden tulips belong to the *Tulipa gesneriana* group and in sixteenth century Turkey these tulips showed practically every characteristic with which we are now familiar, except the so-called parrot form (tulips with lacinate petals). This group of varieties is distinguished by having varieties with both yellow and white grounds, a characteristic not possessed by any other true tulip species (see Hall 1940). This seems to suggest a hybrid origin with a white ground and a yellow ground parent. No wild parent with a white ground, however, is known to exist. Furthermore all the varieties are fully interfertile (although sometimes self-sterile) and at present no hybrid origin is assumed. Hall's hypothesis is "that a mutation from a yellow ground to a white ground arose in a cultivated specimen of some original Gesnerian species and this by cross-breeding with the type gave rise to the cultivated race". This remained ever varying and it has become

Fig. 1. (*Below*) one of the earliest illustrations of a tulip (reproduced by Hall, 1940, from Mattioli, 1565).

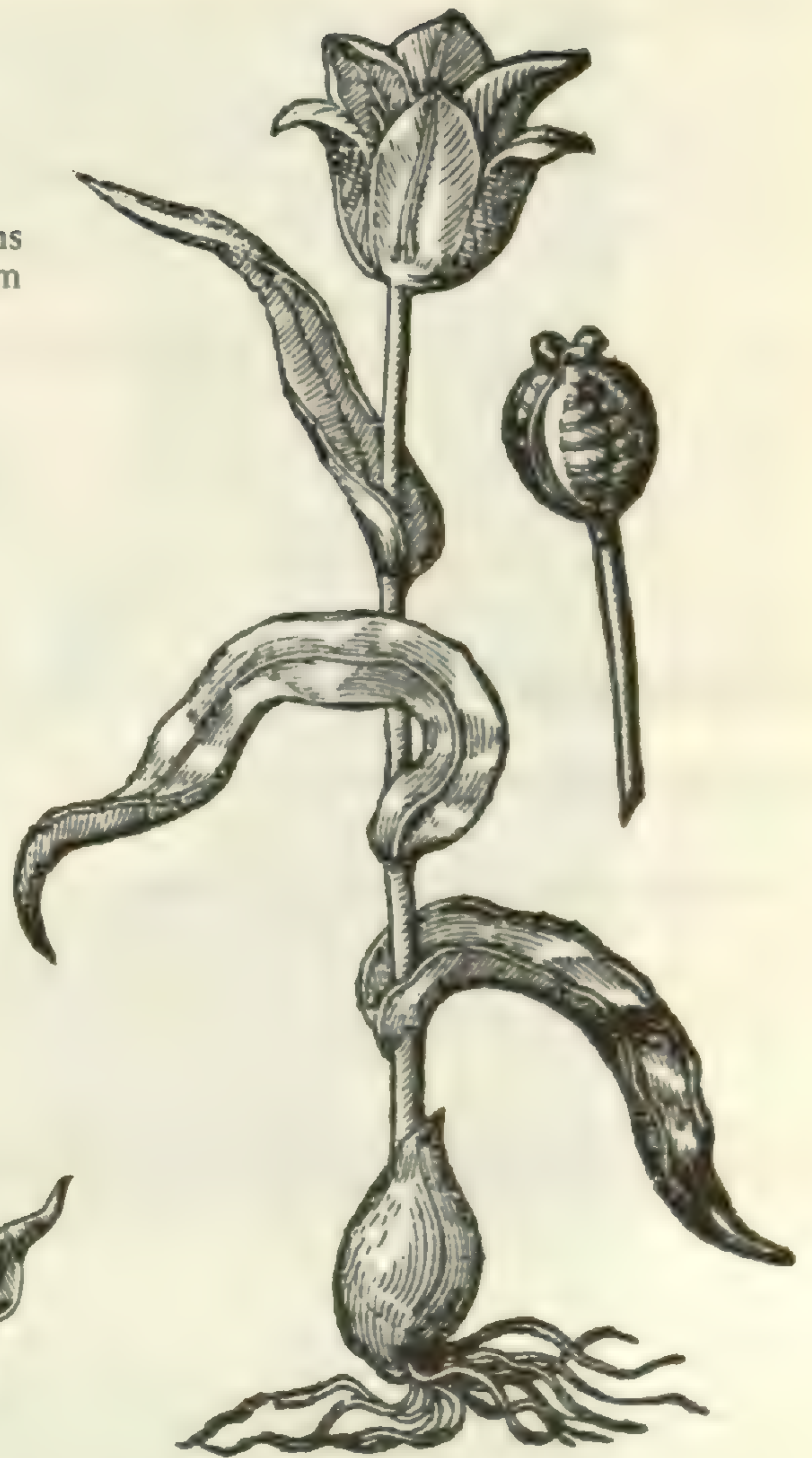


Fig. 2. (*Above*) The illustration of a tulip given by Carolus Clusius, 1576.

impossible to pick up the primitive type among the many semi-wild forms. Probably the primitive type was a yellow-ground crimson tulip with a black blotch margined with yellow. The yellow ground is a simple Mendelian character, recessive to white. This yellow or white color is due to the plastids of the mesophyll. The variety in colors of the tulip is caused by the occasional presence in the cells of the epidermis of crimson or purple anthocyanins. The ultimate color then depends on the shade of anthocyanin and the degree to which the ground color shines through. The Turks cultivated them widely and even had fancy names for them just as we have at present. 'Suleika's dream' was one of them and 'Enhanced joy' another. The Sultan had special tulip-gardens in which many varieties were maintained.

In the meantime the Flemish-Austrian botanist Charles de l'Escluse, better known as Carolus Clusius, (fig. 3) had taken an interest in the tulips, as well as in the many other

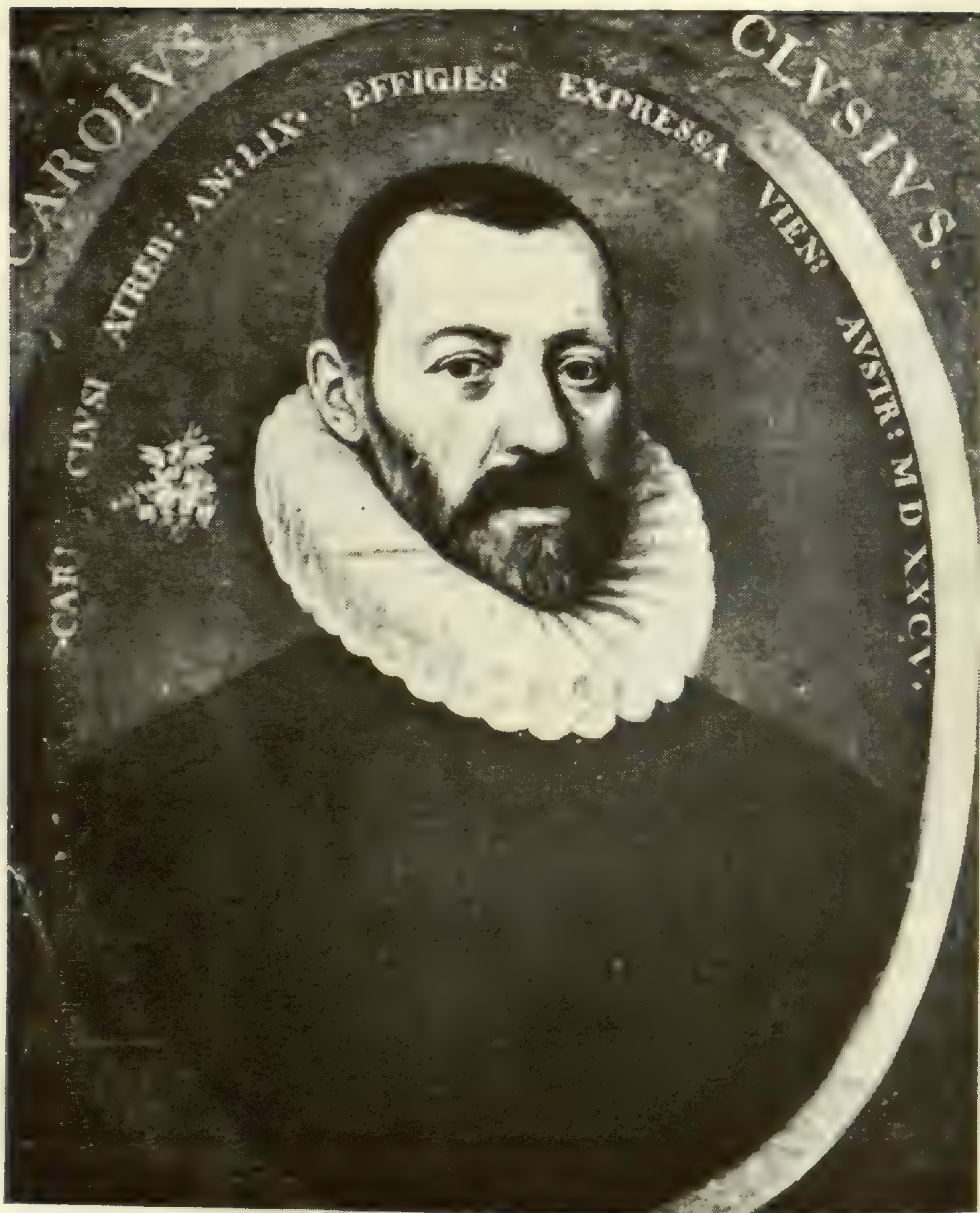


Fig. 3. Charles de l'Escluse or Carolus Clusius, 1526-1609.

plant introductions of his century. This first scientific horticulturist and plant taxonomist lived from 1526 to 1609; his life bridged the entire horticultural explosion that resulted from the renaissance and from the increased wealth and interest of the more well-to-do civilian and aristocratic classes. It was Clusius also who published the first monograph of the tulip. During his stay in Vienna as prefect of the imperial garden he received seed and bulbs from de Busbecq.

The tulip came to the Netherlands quite early, since it is mentioned in 1568 by the famous herbalist Rembertus Dodonaeus or Dodoens [1517-1585], and again by the herbalist Matthias de L'Obel [1538-1616] in 1581. Clusius, however, was the first to publish a more extensive account of the tulips known to him in an appendix to his Spanish flora (1576). It is he who provides us with the anecdote of the Antwerp merchant. He mentions the early and late tulips, the colors yellow, red, white, and purple, as well as the variegated early flowering varieties. He published two amended editions of this monograph, in 1583 and 1601. In the meantime he had been appointed

professor of botany at the newly founded University of Leiden, the first university to be founded in the newly independent United Netherlands. Leiden had been chosen as the place for this university because of its heroic resistance against the Spanish troops in 1574, a victory which virtually consolidated the independence of the Netherlands. Clusius started a botanic garden at Leiden and in it he grew many of his tulips. From this garden but also from other independent introductions came the material for the later bulb industry.

We may well wonder what these first tulips looked like. In general we can say that they were similar to what we now know for instance as the dwarf scarlet Christmas tulip. This type of tulip was called "Duc" at the time, and the tulip described by Gesner looked very much like our present 'Duc van Tol', one of the earliest and smallest of garden tulips (excepting of course the modern *Tulipa kaufmanniana* and other "species tulips"). This is a dwarf tulip, its petals red with a yellow border. The origin of the word "Duc" (Duke) is not known, there may be some heraldic association, but at any rate the term "Duc" stood for a group of early dwarf single tulips. The words "van Tol" simply indicate the name of the originator. This particular van Tol was not a duke at all, he was a Leiden public notary and tulip fancier. In the beginning of the seventeenth century many wealthy people in Holland started growing tulips in their gardens and, otherwise from our present practice, they propagated the tulips not only in the vegetative way through the bulbs, but they also went to considerable trouble to propagate them by seed. True, the original introductions had been both through bulbs and seed, and since the tulips as they grew in Turkey at that time were heavily heterozygous, and did not breed true to type, we can easily understand the great variety of forms that was so notable from the beginning. But somehow this propagation through seed took place only incidentally, and it is an interesting phenomenon that the private tulip fanciers in the Netherlands started to do this themselves. It takes sometimes five to seven years before seedling tulips come into flower: evidently people in those days were quite prepared to go in for a time-consuming and leisurely hobby. The reason that this phenomenon of many private amateur tulip breeders occurred in Holland again has a definite economic background. Since the establishment of Dutch independence in the last quarter of the sixteenth century, Dutch sea-power and consequently Dutch trade and industry had blossomed, creating a new class of well-to-do 'burghers', wealthy merchants, in the western part of the country. The United States are experiencing now the famous phenomenon of the 'second house'; but a similar development took place in Holland during that early booming prosperity. The region best suited for setting up these country houses, or rather country estates, of the new well-to-do but not aristocratic class was on the inland side of the dunes that stretch all along our coast. It is this region that, as we shall see, developed much later (in the nineteenth century) into the great bulb-growing district. At that time, however, the tulip fanciers of Amsterdam, Haarlem, and Leiden started their second houses and country gardens in exactly the right place from the horticultural point of view. The soil and climate were excellently suited and it is therefore no miracle that the early seventeenth century Dutch movement of the second house was also a major factor in creating the later bulb industry. Crispijn van de Passe the younger, in his *Hortus floridus* (1614) provides a picture of such an early seventeenth century Dutch garden. The amateur growers did not grow their tulips for display in mass, for large-scale effects; they grew them for their beauty as individual flowers. This is the reason that we can say that of many of the most famous tulips from the time of the tulipomania there never existed more than a thousand or perhaps even a hundred bulbs in all. The variety of forms and colors obtained was already very great and

intriguing, but this variety was made even greater by a phenomenon that I have not yet mentioned but which became later, throughout the seventeenth and eighteenth centuries, the most important criterion in growing bulbs. I refer of course to the well known "breaking" of tulips, which is the development of a single-colored or self-colored tulip into a variegated one with irregular flame-shaped streaks of white or yellow (the ground) in the original purple or red. From the beginning it was known that the bulbs brought from Turkey all had this curious habit of breaking into variegated forms. The self-colored tulips were not held in high esteem, it was the broken or fine tulips the growers were after. We now know of course that the broken tulips are diseased and harbor a virus which dissolves the pigment (anthocyanins) of some of the cells of the epidermis, thus permitting the white or yellow background to shine through.

It was at the famous English John Innes Institute of Horticultural Science that the discovery was made that the phenomenon of breaking in tulips is due to a virus disease. A major role in this work was played by the discovery that aphids could cause self-colored tulips to break. It is interesting that this disease has been cultivated for three or four centuries without seriously affecting the tulip as such. A broken tulip is not constant in its degree of fineness; after several generations it becomes coarser and coarser and it usually ends simply by dying, for all these virus-infected bulbs have lesser viability. The amateur bulb-growers were eager for these fine tulips and started experiments to break self-colored ones by infecting them by means of tying together a damaged self-colored bulb and one of the halves of a bulb of a broken tulip. Needless to say, nobody regarded this phenomenon as a disease: this practice of infecting healthy bulbs with diseased ones was purely based on experience.

The famous (or infamous) tulipomania reached its height between the years 1634 and 1637 but even before these years some bulbs fetched ridiculous prices. As early as 1623 a single bulb of 'Semper Augustus' (fig. 4) was sold at \$330. Of this bulb it is known that there was never a time at which there were more than 12 bulbs of it! Still, tulips had not yet become objects of speculation: this occurred only in the 1630's. Before those years the tulips were in the hands of some professional growers and a great many enlightened amateurs belonging in general to the well-to-do classes. I say on purpose *some* professional growers, for there was still little real trade in bulbs. We know only a few names of professional bulb-growers, e.g. five in Haarlem in 1637. During the 1630's, however, this tulipomania swept over Holland, and the people most seriously involved in this seventeenth century gold-rush were not the amateur growers or these few professional plantsmen but mostly recent immigrants from Flanders (weavers) and in general simply small wage-earners, who knew nothing about tulips as such. The tulip had become an object of speculation, and it was not the tulips themselves people were after, they were only out for financial gain.

In this country of the gold-rushes I need not elaborate on the interesting pattern of such a social infectious disease. The tulipomania of the seventeenth century had all the characteristics. One might well ask how the strongly Calvinist and usually rather thrifty Dutch became the victim of such a worldly money-fever. When one knows more about this people, it becomes apparent that betting and speculation were and still are favorite sins of the Dutch. I have already mentioned the economic boom of the early seventeenth century, which ultimately gave rise to what we now call the golden age. There was a tremendous increase in wealth but only for the few. Contrary to the affluence of present-day society, the riches were concentrated in the hands of a numerically small but socially very important class of merchants and industrialists. Most of the rest of the people lived in poverty. Many people died of hunger in Holland, indeed throughout Western Europe,



Fig. 4. 'Semper Augustus', one of the most famous broken tulips from the tulipomania (reproduced by Krelage 1946 from a 1636 tulip-book).

in those affluent times. Furthermore, infectious diseases swept the country time and again, especially the plague; and its victims were seldom among the well-to-do, who lived sufficiently far away from the rats. The tremendous extremes of wealth stimulated gambling, betting, and speculation. Practically everything served for a wager: the issue of a battle in the war against the Spaniards, the fate of the crop in a rainy season, the success of an expedition to the East Indies. Why precisely around the year 1635 this speculation turned to the bulbs is difficult to say, but at any rate the general economic background was favorable for it, morale had been loosened even more by a particularly heavy epidemic of plague in the years 1634 and 1635, and religious quarrels between opposing factions of the governing classes did nothing to restore confidence in the churches. In the season 1635-1636 prices rose to extreme heights, and this was repeated in the next winter of 1636-1637. There was no time to grow new tulips for this took several years. In all about five hundred varieties of tulips were involved in the tulipomania; four hundred and fifty pictures are known to exist. The speculation then had as

its object the relatively small numbers of bulbs made available by the growers and the amateurs. Everybody started propagating tulips in his small back yard or city garden, and the results, as far as quality is concerned, can be imagined. The trade was carried on in taverns and followed strict rules which are too intricate to be discussed here. One interesting parallel with the gold rush is that during the height of the speculation the bulbs were sold par "aas" a unit equal to one-fifth gram used by the goldsmiths of the time. Tulip bulbs that had not yet been lifted changed owners many times and the trade became typically a swindle when more bulbs were being sold or promised than there were actually available in the country. Of the prices paid for one bulb some have become famous: One 'Semper Augustus' of 193 aas (about 40 grams, or a little more than one ounce) was sold for \$1200 cash plus a new carriage with two dapple-grey horses to be delivered within four weeks. The \$1200 was to be paid on the spot but the bulb would be supplied later.

There are many stories of this kind, but only a few are really based on written legal contracts. The famous story of the 'Viceroy' bulb which was sold for two loads of wheat, four fat oxen, eight fat pigs, and some twelve other huge quantities of food is a fable based on a contemporary estimate of what one could buy for the price (in cash) that one bulb had fetched. Most sales were effected for cash, as one might expect in times of speculation, since this promotes a more rapid turnover of the money.

This stock-exchange speculation had all the familiar characteristics of gambling. Bulbs were offered for sale which remained in the hands of the grower or dealer while they were nominally changing hands several times before delivery: planting time. Ultimately the dealer kept the bulb himself, and reimbursed the latest owner if it had gone up in price, or was reimbursed himself if the price had gone down.

The crash came, inevitably, in the early spring of 1637: everyone wanted to sell and the market was flooded. Some unfortunate dealers went to the trouble to set up mock auctions to keep up the prices, but they were of no avail. The government intervened and made special regulations nullifying all contracts and agreements made after a certain date. Most of the growers and speculators quickly cut their losses and accepted in ready money only a fraction of the fancy prices. The tulips reverted to the growers and the amateurs and a great many people lost fortunes they had never really owned. It will be clear that this short inflation of the tulip did relatively little damage: the people who lost their fortunes were just as poor as before, and the growers and plantmen found themselves again in the legal possession of their bulbs.

A flood of pamphlets accompanied the tulipomania, all in Dutch and difficult to translate. One result of lasting importance may be mentioned here. The trading often took place on the basis of colored plates, mostly watercolors, of the tulips, plates of which many examples survive today. The plates were bound together in tulip-books which were in fact a kind of sales-catalogue. Some of these tulip-books are of great beauty and were made by some of the most outstanding painters of Holland. Needless to say, these tulip-books are now extremely rare. Quite a few of them are still in Holland, mainly because of the activities of Krelage who collected them before other amateurs came on the market.

The tulips of the tulipomania are all extinct. This is nothing remarkable: after all they were practically all "breaks" of fine tulips, that is diseased plants, and they were bound to disappear pretty soon. Some of the breeder tulips of the time are still extant: these were the self-colored tulips used to obtain new broken varieties.

The fancy names of the tulip varieties or cultivars have often been commented upon. I have already mentioned the "Dukes" which were a kind of tulips, a class of cultivars

denoted by the term "Duc" followed by the name of the originator. These originators then were anything but dukes: after all the Dutch had done away with all their dukes in the revolution against Spain, so why revive them? There are, however, a great many tulips called either Admiral so-and-so or General something. This might lead one to the erroneous conclusion that the Dutch were very militaristic. They were not: the terms "Admiraal" and "Generaal" were used in the same way as "Duc" not, however, to indicate a certain kind, but to denote a certain degree of excellency. The best varieties from a certain group were called Admiraal so-and-so the so-and-so being the originator.

The tulip trade before the tulipomania was of very small importance; this changed after the infatuation. The tulipomania was the best possible publicity campaign for the Dutch trade. If only it had been brought about on purpose we should have been able to compare the authors of it with our best sales-managers and publicity agents of today. The tulipomania started an enormous interest in the tulip in Western Europe. At balls, dances and weddings at the French court tulips were worn by the ladies as a status symbol. In fact the bulb industry as such was born out of the tulipomania. Serious growing and propagation for the international trade were started in those days and have continued until the present time. True, tulips were not yet used in mass as they are now; they were still grown essentially for their qualities as individual flowers. The value was the greater because very little was known at the time about advancing the date of flowering, so that the season lasted only two months at most. The trade and industry concentrated upon growing these broken tulips until after the Napoleonic wars. Apart from Holland the tulip was grown commercially in Flanders and England during the seventeenth and eighteenth centuries. These centers produced mainly for the local markets but developed in much the same way as the Dutch, that of growing breeder tulips mainly for the purpose of breaking them. The Flemish and northern French growers, however, concentrated more on round flowers with long thick stems, and also selected more broken tulips with a yellow ground (*bizarden*), whereas the Dutch growers specialized in square flowers on shorter stems and broken varieties on a white ground (*bijbloemen*). This divergence proved to be of considerable importance in the late nineteenth century. The eighteenth century was one of a relative decline of the tulip in Holland and of greater success for the hyacinth but that is another story. There were still a number of wealthy amateurs who kept large private collections. In the beginning of the nineteenth century horticultural ideas changed and tulips were asked for to create designs in landscaping and gardening. This immediately favoured the propagation of the self-colored breeder tulips, which had been kept hitherto simply to provide fresh basic material for broken or fine tulips. From now on tulips were grown for their spectacular colors, as they are grown nowadays. It will be clear that this was also the actual beginning of the tulip-fields as we know them now. The breeding of fine tulips for a trade specializing in single high-priced bulbs took place in relatively small gardens or fields, mainly around Haarlem, but the new demand for tulips in quantity gave birth to the famous tulip-fields. This development started in the 1830's, two hundred years after the tulipomania. True, the variety was not very considerable as compared with the stupendous wealth of forms and colors with which we are confronted today. The professional bulb-growers started propagating tulips from seed and collected as many varieties as possible. For this purpose they used also other collections of tulips which were still maintained by amateurs in England, Belgium and Holland. The most spectacular advance made in the nineteenth century was no doubt the discovery of the Darwin tulips by the Haarlem firm of E. H. Krelage and Son. This firm bought an old collection of tulips somewhere

near the French-Flemish town of Lille, which was going to be abandoned. This collection had been grown by one family for over a century and many of the varieties in it had been obtained by sowing tulip seed obtained without any definite and conscious program of cross-pollination. In that Lenghart-Tripier collection of 3000 different breeder tulips and 800 broken ones J. H. Krelage [1824-1901] discovered what we now know as the Darwin tulips, the long-stemmed, late, large-flowered, single, self-colored tulips which are so well known. They were distinguished from other tulip varieties by their size, color, and gloss, and Krelage with the good eye of the true breeder, immediately saw his chance and started large-scale propagation; he also restored the market for late-flowering tulips. The original Darwin tulips were, therefore, not the result of a direct breeding program, they were the result of selection from an existing great variety of forms obtained by continuous, unintentional, more or less natural cross-pollination, followed by propagation by seed: in short the same method by which the variety of forms first arose in Turkey and shortly after the introduction of tulips into Western Europe. The Darwins were first exhibited in 1889 at Paris and soon became so popular that they provided a new stimulus for the whole industry. From these Darwins again "broken", virus-diseased varieties were obtained in the Flemish collections and propagated as the now well-known Rembrandt tulips. Later, around 1900, the Darwins were crossed with dwarf single early Duc van Tol tulips and thus gave rise to the Mendel tulips. These Mendel tulips, therefore, were the first tulips obtained by a planned program of cross-pollination.

I should mention also the "cottage tulips" a group of late flowering tulips obtained from numerous varieties collected by English growers in old cottage gardens. These cottage tulips (themselves late) were also crossed with single early varieties and gave birth to some of the Triumph tulips. Other Triumph tulips have Darwin as ancestors.

The situation at the end of the 19th century was therefore the following: there was a group of early tulips (Duc van Tol dwarfs, single and double earlies) and a group of late tulips (the old breeder tulips, the broken tulips, the selections called Darwin and Cottage tulips). As a first result of intentional cross-breeding the Mendel and Triumph tulips arose. The beginning of the 20th century therefore witnessed a spectacular increase in the number of varieties, mainly due to careful selection and breeding programmes. The tulip had already been in general cultivation for 300 years, but even after such a time it was still possible to provoke a radical revolution in the industry by modern methods. However, the improvement of the old *Tulipa gesneriana*, the garden tulip complex, was not all. The times were ripe for even further spectacular advances.

The last important step in the development of tulip breeding was taken by the Haarlem firm of C. G. van Tubergen Jr. whose director J. M. C. Hoog [1865-1950], sent out plant collectors (P. Sintenis, P. L. Graeber, A. Kronenburg, J. Haberhauer) to Turkey, Armenia, the Caucasus, and Turkestan to collect wild species of tulips. The result has been stunning although it should be realized that it took some forty years before the effects of this far-sighted program became of importance for the market. We all know the splendid 'Red Emperor' which is a selected strain from the tulip species *Tulipa fosteriana* collected for Hoog by Haberhauer in 1904 in Samarkand and described and named by him in the appropriate botanical way. This 'Red Emperor' variety was received only once from the wild, in the first Turkestan collection by Haberhauer. All plants in cultivation go back to a single bulb: it is a clonal selection. This *Tulipa fosteriana* has been used in breeding programs to improve the Darwin tulips, and many cultivars are now on the market which have *Tulipa fosteriana* blood in them.

Other wild species also proved to be a great horticultural success: *Tulipa kaufmanniana*, *T. greigii*, and *T. eichleri* are well known. *Tulipa kaufmanniana* is known as the water-lily tulip; one of the most promising developments in the bulb industry today is the extremely early time of flowering and the absolutely new array of colors and forms obtained by crossing it with other species of *Tulipa*. At present there are some 4000

cultivars of tulips listed in the official international register (there were 1323 in an eighteenth century Turkish register!).

The story of the tulip, of which I have given a very short outline is as fascinating as the plant itself. There are few plants of horticultural importance whose history is so clearly linked with that of Western Europe and of Holland.

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COVER PICTURE

Japanese Flowering Cherry
Prunus yedoensis, c.v. 'Akebono'

JOHN VALADEZ

Six white clouds, tethered a few feet above the lawn, describe the massed bloom effect of the Japanese flowering cherries, *Prunus yedoensis*, c.v. 'Akebono,' which are located in the Display Garden at the foot of Tallac Knoll. The pink tinged buds unfold to soft white petals, 5 petals to a flower and the flowers suspended in clusters envelop the whole tree.

Like the famous cherry trees in the Tidal Basin in Washington, D.C., the Arboretum trees were in bloom from mid-March through mid-April.

The trees were a gift of Sunset Magazine. They were planted, bare root, early in 1957. The tallest tree now measures 12 feet. Since trees of this variety usually do not bloom well until much taller, this year's even and full bouquet of flowers was a real bonus.

Growing trees in beds of annuals, as opposed to growing them where they can be watered and fed for their own needs, can cause trouble. The Display Garden trees are planted in beds of annuals which are changed twice a year. The only real problem here was one of chlorosis and after a treatment of iron chelates this condition disappeared.

The natural rounded shape of the trees has been easy to maintain. A couple of shoots taken off here and there, and the usual few crossed branches removed, has been all that was needed, in the way of pruning.

The trees have been disease and insect free. The leaves dropped in a short time, a real advantage in our climate where the leaves of some of our deciduous plants either get bug-eaten or are slow to go dormant in the fall.

Either singly or in groups, these trees mark the reappearance of spring. In this area where spring, though of long duration, comes on so gradually, it is refreshing to see trees which literally burst into bloom.

Studies on Chemicals to Protect Plants from Smog Damage

ARTHUR LANZ AND W. S. STEWART

It is generally recognized that ozone and other oxidizing agents are found in abnormal amounts in Los Angeles smog. The action of ozone in reducing oxygen uptake of plant and animal mitochondria can be prevented or even reversed, by the addition of excess amounts of either glutathione (reduced form) or ascorbic acid (Vitamin C)⁽²⁾. In further studies it was found that dilute sprays of the potassium salt of ascorbic acid were effective in counteracting plant damage caused by Los Angeles smog⁽³⁾. Plants responding to these sprays were: Calendula, Petunia, Snapdragon, Romaine Lettuce, Tomatoes, Bountiful Bean, Pinto Bean, Grapefruit, Cleopatra Mandarin, and Sampson Tangelo. Petunia are among the most smog susceptible plants known. Other plants than these were not tested except Cattleya orchid flowers which did not respond presumably since they were injured by the ethylene component of the smog rather than oxidants. In experiments conducted in Connecticut, by other investigators, tomato plants sprayed with a trial fungicide (manganous 1, 2-naphthoquinone-2-oxime) were protected against damage apparently caused by excessive atmospheric ozone⁽⁴⁾.

Studies on the effect of air pollutants on plant tissue are being conducted at the Arboretum with support from the U. S. National Institutes of Health. (Research Grant No. AP 132-05). The studies have been based on the effects of smog on cultures of various kinds of plant tissues. During the past year and a half cultures of carrot secondary phloem tissue have been grown according to the method of Caplin⁽¹⁾ with minor modifications which will be published later in detail.

In general the procedure consists of placing a 2 mm (one-twelfth inch) plug of carrot tissue of 3-4 mg. weight on a nutrient agar media in a 125 ml Erlenmyer and growing this tissue for 21 days. At this time it usually shows a ten fold increase in size. Each culture is then weighed and at least three cultures are exposed to each of the treatment conditions being studied. The cultures are all exposed to the same volume of air but half of them receive air filtered through activated carbon to remove the pollutants. The cultures are grown for 14 days following exposure and weighed again to measure the effect of the smog on their growth. By this technique it also is possible to determine the effect of various chemicals added to the nutrient agar on the growth and response of the cultures to smog.

Using this method it has been found from repeated trials that reduced glutathione at a concentration of 20 ppm (parts per million) in the nutrient agar completely counteracted the growth suppressing effect of the smog exposure. In comparison with cultures in filtered air, those exposed to smog grew only about one half as much; however with glutathione in the agar the growth was equal to that of the cultures in the filtered (no smog) air. Similar results were obtained using 20 parts per million of cysteine base in the nutrient media.

In view of these clear cut responses, and since no previous studies reporting effects of glutathione sprays in counteracting smog damage on intact plants could be found in the literature, leaves of Petunia plants were sprayed on September 24, 1962 with various concentrations of reduced glutathione. It was found that the glutathione spray at 100 parts per million almost completely eliminated smog damage. Concentration of 40 ppm or 20 ppm reduced damage but to a lesser extent. These experiments have been repeated several times with similar results. A soil addition of cysteine also was effective in protecting Petunia leaves from smog damage.

A single preliminary test using chemical methods has indicated that the sodium salt of ascorbic acid may surpass glutathione or cysteine in counteracting smog damage. Plant spray and tissue culture tests making these comparisons are now in progress.

It is suggested that since glutathione, cysteine, and presumably sodium ascorbate are effective in protecting plant tissues from smog injury, possibly these same chemicals could counteract irritating effects of smog on human tissues. For example, eye irritation might be eliminated by an eye lotion or ointment in one form or another using these chemicals; or, using these substances as a nasal treatment they might overcome the irritating effects of smog on the respiratory tract. These suggestions are being investigated.

As these studies continue a more detailed and technical account of this work will be published. Also information will be made available on sources of chemicals, costs and methods of using smog protecting sprays and chemicals for plants.

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Garden Tour of the Medical Center at U C L A

DORA GERARD

To the casual observer the gardens and patios of the Medical Center present a pleasing arrangement, but few realize that the landscape planning has been a continuous activity since 1953. The head gardeners have copies of the landscaping blueprints to guide them in their work. One of the main problems is to provide attractive gardens on temporary sites where construction is planned within five years or less. In these locations fast growing, inexpensive material is used; automatic time-clocks are not installed in the sprinkler systems; sidewalks are of asphalt rather than concrete; removable trees are planted in boxes; benches are portable. The play area of the Marion Davis Clinic will be a good example of this. Walls will be of concrete block which is cheaper than cement, the removable trees, play equipment, patio of rock and sand, and fences can be salvaged for use elsewhere. Temporary landscaping has to be done for other than ascetic reasons, because without ground cover plants, the soil would erode and damage the buildings. In the garden areas of the Medical Center there are roughly 31 species of trees, 56 of shrubs, 15 kinds of ground covers and 4 types of vine; this amounts to approximately 150 individual trees, 890 shrubs, 19,167 separate ground cover plants and 10 vines. Most are tropical from countries with a similar climate to Southern California. Just a few of the outstanding plants are mentioned below.

In front of the hospital are some *Strelitzia reginae*, the Bird of Paradise, native flower of the Cape of Good Hope. Note the exotic flowers which resemble a bird taking flight. The bird's head and neck is a pointed sheath, while the crest is formed by flowers rising from it—the brilliant orange contrasting with the bright blue tongue. The vine on the front wall of emergency is *Calliandra inaequilatera*, from Ecuador, commonly known as the Pink Powder Puff. Around the Marion Davies Clinic are many Hawaiian ferns, the blonde or female treefern of the rainforest. On Westwood Boulevard near NPI are the *Eucalyptus viminalis* or Manna Gum trees. This tree, from Tasmania, is called Manna Gum because of its exudation of a sugary substance. In coastal areas the rough bark is seasonally shed in long ribbons, leaving a clean white trunk, so it is also known as White Gum. The foliage of the Manna Gum is the principal food of the Koala bears in Australia. In front of NPI on Westwood are four *Erythrina coralloides*, Indian Coral, tall trees which burst into pointed red blossoms in mid-winter and early spring when they are leafless.

In both center patios trees are in boxes because there is no soil underneath. They will have to be replaced in a few years as they will become potbound. The trees are *Ficus elastica rubra*, an ornamental form of fig not used for fruit or rubber. Among the succulents are *Sedum album*, derived from the Latin word meaning "to sit;" *Agave attenuata* from Mexico, the American century plant which blooms when ten years old and is of economic importance for rope manufactured from the fibre, food, beverages, soap and other products of the pulp. In the West patio there is a color scheme of blue and gold in spring. On the pergola just outside the cafeteria is a beautiful example of *Thunbergia grandiflora* or Clock-vine from India, sometimes called the Blue Skyflower or Bengal trumpet, a woody twiner which drops strings of bell-like lavender-blue flowers. In the center beds are a mass of *Agapanthus orientalis* from the Eastern Cape of South Africa, blue flowers interspersed with a few of the white variety. Today this flower is commonly known as the Lily of the Nile, although in earlier times the Calla Lily was called the Nile lily. This year there will be no blooms, as the entire bed was given new soil and the plants thinned and trimmed. The vine near the arch is *Solandra gutta* or Cup-of-Gold, from Mexico, a spectacular tropical flower with a great banana colored chalice feathered with purple inside; when the buds begin to unfold, the petals move so rapidly that one can watch the blossom open. This is one of the most salt-tolerant of all vines and can take salt spray directly above the tide line. The trees along the wall of the Library patio are *Bauhinia variegata* or Orchid tree from India; this "poor man's orchid" with lavender and white flowers is not related to the orchid family in any way, but belongs to the Leguminosae or Pea family.

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NOTE: With this issue Lasca Leaves begins a new phase, being published once again solely by The California Arboretum Foundation, Inc.

COVER PICTURE

Citron Crested Cockatoo (*Kakatoe sulphurea citrino-cristata*) is a sub-species of the better known Sulphur Crested Cockatoo. Wild, it travels in huge flocks; captured, it becomes a tame and teachable pet.

Bird owned by Rudkin Aviaries, Fillmore, California.

CALIFORNIA ARBORETUM FOUNDATION NEWS



Supervisor William G. Bonelli witnesses the passing of the gavel from Ralph D. Cornell to F. Harold Roach with Director William S. Stewart.

* * * * *

The final report of President Ralph Cornell was heard at the summer meeting of the Board of Trustees of the California Arboretum Foundation before he turned the gavel over to incoming President F. Harold Roach. The dinner meeting was held in the Arboretum Lecture Hall on Tuesday evening, July 16, with Mr. and Mrs. Cornell as hosts.

Highlight of that report was the proposal that production of Christmas Cards with Arboretum inspiration by an outstanding California artist should be our next effort. Henry R. Mockel of Twentynine Palms has been asked to prepare suggestions, and by our next issue we hope to be able to let you see for yourself the results.

Thursday, October 3, has been selected as the date of our Orchid Print Sale. Members and friends of the Arboretum Foundation are urged to come and enjoy viewing this outstanding collection of lithographs. Bidding will be by silent auction between six and seven-thirty in the evening.

The first Members' Tour of the Fall will be held at the Arboretum at 10:00 a.m. on Monday, October 7. Come and bring your friends!

* * * * *

DESCANSO GARDENS Night Lighting Festival sponsored by the Guild was so highly successful during the month of July that it was held over into August to give more visitors an opportunity to enjoy this unique event with the Gardens at their summer best.

* * * * *

SOUTH COAST BOTANIC GARDENS FOUNDATION members are hosting the American Dahlia Society at the Trial Gardens established last year along Rolling Hills Road. In addition to seedling dahlias under trial, plans include mass plantings in color blocks labeled for easy identification and a botanical dahlia collection of species.

CALENDAR OF EVENTS

AUGUST

Educational Films — each Saturday in the Lecture Hall

Art Exhibit — "Digging Up the Past" — in the Coach Barn

Radio Program — "Horticulture and Gardening" KMAX-FM 107.1 Mc

2:30 p.m. August 9 and 23

Television Program — "Wonderful World of Ornamentals" (Color) KNBC

Channel 4 — Each Saturday at 1:00

SEPTEMBER

Arcadia Historical Society — Board of Directors

Adult Education Classes:

Plant Combination Theory in Professional Landscaping

Park and Golf Course Management

Home Horticulture

Home Landscaping

Plant Identification

Plant Propagation

Plant Breeding

Botanical Sketching

Children's Education Classes:

Nature Workshop

Plantcraft

Greenhouse Propagation

Exploring Nature

Indians and Rancherias

Indoor Gardens

Gardening

American Orchid Society Awards Committee

California Garden Club — Arboretum Branch

Pasadena Horticultural Society

San Gabriel Valley Branch American Begonia Society

San Gabriel Valley Orchid Hobbyists

Art Exhibit, Radio Program and Television Program as above

Too Many Cockatoos

MARGUERITE E. BUTTNER

An Australian farmer in west New South Wales inspected his fields from his jeep one morning. The span of wheat reaching to the horizon was punctuated now and then by solitary Eucalyptus trees. A few were only hollow black skeletons, marking a rainless year sometime back.

As the farmer drove slowly past one dead tree, he heard a crackle and an annoyed squawk. He looked up. A lone Red-Tailed Black Cockatoo sat splintering a piece of hard wood in its beak. The bird's crest was raised angrily above its speckled face.

"How unlike it's cousins," the farmer thought. "What is it doing here alone? An outcast?" He knew this kind usually preferred the mountain forests farther east. The natives of the Bush said, "A black Cockatoo in an unaccustomed place means rain within a fortnight." A superstition, perhaps, but he hoped it was true.

A wheat farmer didn't mind this species. It fed inoffensively on tree seeds and beetle larvae. Perhaps this bird was returning to a tree it had known before—sometime in the last century when koala bears were still abundant and lived in the Eucalyptus' branches. This bird could be much older than the farmer.

That ghostly trunk with most of its limbs gone was a favorite resting place for other Cockatoos as they ranged over Australia's interior looking for food, but seldom did a rare black one light on it. A pink and white Leadbeater's Cockatoo had built its nest in the hollow trunk once. The farmer's wife had taken one of the three fledglings for a pet and trained it to talk.

He drove on, then stopped, focusing binoculars on a distant tree. Faintly he saw what he knew was another Cockatoo. This time he was aroused. He knew the species well, the galah. It appeared to be alone; but it was not. Its face, neck, and breast would be rose; its back and wings, a soft blue-grey that shaded to white. Its head had a crest of delicate pink and white. "Why do the most beautiful birds have to be the most destructive?" he said half aloud. He sped toward it, but the bird had already spotted him. It shrieked. Instantly hundred like it rose from the field where they had been greedily consuming wheat. With frightened cries, wings whirring, they circled upward flashing specks of pink and grey as their wings raised and lowered, showing their breasts, then their backs in the sun. The farmer would have shot at them if he had been closer, just as all other farmers like him would have done. Australians used to trap galahs and some other species for the price they brought from American aviculturists. Now a Psittacine import ban in the United States had closed their best market.

The most intelligent of all the Parrot family and yet they threatened crops as perniciously as the drought. The flocks were getting smaller. For that farmers were grateful. Galahs spent much of their time in the uninhabited deserts, but they came to the scrub belts and grasslands along the Murray River in search of food. Even though they also consumed quantities of noxious weed seeds, this did not repay the farmer for the thefts. White Cockatoos and the little Cockatiels were just as bad and even more numerous. Only the blacks were unobjectionable and they were few.

While farmers were rejoicing over diminishing flocks, ornithologists were troubled. They knew what had happened to other grain-eating birds. North America once had a Psittacine species, the Carolina Paroquet, which swarmed over the South like crows. Gradually farmers destroyed the entire species.



Figure 1. The Galah or Rose Breasted Cockatoo (*Kakatoe roseicapilla*) inhabits the desert plains of Australia but comes to the fertile grasslands to feed on seeds and grain crops. Its breast, neck and face are rose, its back and wings, a blue-grey, and its head has a crest of delicate pink and white. This bird is as familiar and as annoying to Australian farmers as crows are to American.

Bird owned by Rudkin Aviaries, Fillmore, California.

Although Australia still has vast uninhabited interiors, its conservation problem is serious. Bird flocks along the fertile east coast where population has concentrated have diminished considerably. Those of the interior have not, but central Australia is desert where few birds can survive indefinitely. The loss of Australian wildlife is of concern to all the world because the land "down under" has the most unusual fauna.

Although Australia was the last continent to be settled by civilized people, it is geographically one of the oldest regions. Originally it had the same types of wildlife as Africa and South America, but as it became isolated from other large land masses, each type developed its own characteristics. The kangaroo, the koala bear, the wombat and other marsupials which carry their young in abdominal pouches are unlike their nearest relatives in the rest of the world. Of Australia's 616 bird species, 431 have not been found on other continents. Psittacines of many sorts inhabit the tropical and subtropical world. Cockatoos are found only in Australia and neighboring islands.



Figure 2. Citron Crested Cockatoo

Of the six sub-families of Psittacines, the Cockatoo is considered to have the most advanced evolution. From the perky dove-size Cockatiel to the 29-inch formidable Palm Cock which inhabits Queensland's jungle in the north-east, their beaks are, like all Parrots, powerful and hooked, capable of stripping bark or killing a snake. They have strong feet which, with the help of their beaks, enable them to climb or to hang upside-down as clownishly as monkeys. They have mallet-shaped tongues adept at mimicking human speech, but their natural voices are harsh, increasing in volume with their size. Like other wild Psittacines, Cockatoos in nature have no interest in talking. They imitate instead noises of their kin, appropriate for communicating with each other. And like other members of the Parrot family they usually gather in flocks rather than isolating themselves like owls. But Cockatoos are quite different in several respects.

For one thing their color schemes are different. None are vivid Amazon green or Macaw scarlet and blue or Parakeet turquoise. They are predominantly white, black, grey, or brown, relieved by pink, white, red, or yellow on breast, tail, head, or cheek. The rose-breasted galah (*Kakatoe roseicapilla*) has sometimes been mistaken for an African Grey Parrot because of its grey back, but the African Grey has no rose breast or crest.

In fact, another striking difference is all Cockatoos have crests which they raise when excited or happy and lower when in repose. Some species found both in Australia and the islands are identical except for the color of the crest, indicating that they do not ordinarily travel back and forth over water.

A third difference is that Cockatoos produce a waxy, water-repellent powder which they dust all over themselves with a tuft of feathers at the end of their spine and with their crests. This powder gives the white birds a snowy cleanness; the grey and rose, a softness; and the black and brown, a greyish cast.



Figure 3. Red Tailed Black Cockatoo (*Calyptorhynchus magnificus*) also called Banksian Cockatoo, lives in mountain forests of Eastern Australia. Trigger-happy feather hunters have made this bird quite rare. Owned by Rudkin Aviaries, Fillmore, California.

Best known in the United States are the white Sulphur Crested Cockatoos (*Kakatoe galerita* and *K. sulphurea*) which have several subspecies, differing slightly in size or markings and in crest color. Although all the crests of this group are yellow, the yellows vary from lime-yellow to orange-yellow.

The pink Leadbeater (*Kakatoe leadbeateri*) is much like the white except it has pink under its wings and has red and yellow horizontal strips on its crest. The Moluccan, another pink bird (*K. moluccensis*) has a salmon crest and salmon pink inner feathers. This one is rare but exceptionally beautiful.

The blacks include the Red Tailed Black (*Calyptrorhynchus magnificus*), the Glossy Black (*C. lathami*) and the Palm (*Probosciger aterrimus*), which actually is charcoal-colored. The Yellow Tailed Black, called the Funeral Cockatoo (*C. funereus*) and the White Tailed Black (*C. baudinii*) both are dusty brown. All of these are handsome birds except for the Palm Cock which has a steel grey crest that looks like a head-dress of curved knife blades. He has huge, bare, pink cheeks which flush when he is excited and turn blue when he is cold. Despite his ferocious appearance, he can be very gentle.

The blacks, once very numerous, inhabit the mountain forests in eastern Australia, and even though they never were pests, they have been game birds since the first European adventurers' arrived. The white and pink birds live mostly in the interior which is still sparsely inhabited. Some species were never seen by European settlers until 1900. These interior birds are extremely wary; hence they keep a lookout stationed in a tree while the flock is feeding. This partly explains why the pink and white species are more plentiful than the unobjectionable blacks.

The grey Gang-Gang (*Callocephalon fimbriatum*) is an odd creature with fish-scale feathers, but the male has a beautiful red head. Like the blacks, it lives in timbered mountains.

The Cockatiel, or Quarrior as the Australians call it, (*Nymphicus hollandicus*) is grey with white patches on its wings and yellow on its crest. The male has a yellow face. The Cockatiel, unlike its cousins, has a long tail and is considered the link between Cockatoos and true Parrots.

Although destruction of an entire race is seldom intentional, it is often inevitable without strict conservation laws. Not only farmers and hunters, but landscape improvement people who remove the dead trees all Cockatoos use for nesting, contribute to decimation. Conservationists are working conscientiously now, but their efforts in Australia as elsewhere are hampered by expanding human population. The best answer for Cockatoo survival may be aviculture.

Ornithologists who appreciate birds in their natural environment are often appalled by the aviculturists' artistic cages for what, they feel, was meant to be wild. But gradually much of the world's fauna and flora as well as mankind are having to adjust to artificial environments. The only living remnants of some species are already found only in public parks or private collections. The ornithologist and the aviculturist, therefore, are working closer together today than ever before. Without the ornithologist's information about bird habits, the aviculturist would be helpless.

In spite of all the war between man and cockatoo, this bird is, when caught young, most easily tamed. Being flock birds, they like company. Just as a lonely person enjoys a pet for companionship, so the lonely bird appreciates man and often becomes devoted to its keeper.



Figure 4. Looks are deceptive. This particular Palm Cockatoo (*Probosciger aterrimus*) is a gentle fellow who seemed to enjoy posing for a picture. His beak is adept at splintering hard wood or killing a snake though. This species lives in Queensland jungles in Northeast Australia, but this particular bird is owned by Rudkin Aviaries, Fillmore, California.

The Cockatoo's exceptional intelligence makes it very adaptable in captivity. Its intelligence also makes it highly individualistic. In captivity it may be a one-man bird or it may scream at men and chatter gently to women, or it may take a dislike to all people and become an untamable "bronco." Each species includes individuals which tame easily and those which do not. The size of the bird and the loudness of its voice influences whether it is kept indoors in a cage or outdoors in an aviary. Confining a large creature to a small space is cruel, but a well-trained Cockatoo can be given as much liberty as a dog and use the cage only for sleeping.

Another result of their intelligence is the ability of the Cockatoo to clown and to be aware of admiration. If they see that raising their wings peculiarly brings praising words, they will do it often. They will kiss, chatter, climb in some crazy manner just for attention. They usually recognize a friend by voice and distrust a silent person.

A bird must be tamed before it will talk. Patient repetition of simple words is essential. That parrots mimic but do not know what they are saying is a well-worn cliché, only partly true. All bird chatter is a form of communication. The great Palm Cock has a harmonious "Hweet, hweet" for reminding his kin or his keeper he is around, a smooching sound when his pink cheeks are rubbed, and a grating screech when he is hurt. This is his natural language. Whether he picks up a line from Shakespeare, a resonant blasphemy or a wolf whistle, he is saying in effect, "I like you. Please notice me," when his tone is pleasant. By patiently associating appropriate words with rewards of food or with acts that the bird understands, some trainers have been able to get their birds to talk in the sense of communicating. Talking birds should be an interesting study for a semanticist.

Although Cockatoos are not rated as high as the African Grey or the Amazon Parrot for tone quality and vocabulary retention, they do talk if they are trained young enough. Many keepers, however, have them primarily because of their beauty and personality. They add an artistic accent to exquisite decor and their antics are always amusing. Evidently enough people are willing to spend from \$250 to \$400 for each Cockatoo so that buyers are always more numerous than birds. Some hybrids cost more. Cockatiels require less space and breed more generously so they cost from \$12 to \$25. Because of the import ban, only those bred in this country are available.

One might ask if there is any place where Cockatoos could be naturalized in the United States as Peacocks have been at the Los Angeles State and County Arboretum. California's climate is similar to Australia's with open deserts and mountain forest, and Eucalyptus trees are planted by the thousands. Unfortunately for Cockatoos most of the trees are living and not suitable for nests. The blacks might adapt themselves to man-made nests somewhere in the mountains, but there are so few of the species to begin with and they do not breed unless they are happy with their environment. The whites could adjust to deserts but then they would seek out grain crops and find American farmers no more hospitable than the Australian. So the Cockatoo's survival seems mostly up to the aviculturist.

THE END

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Insects and Plant Protection

J. ALEX MUNRO

The word "insect" comes from the Latin *insectus*, meaning "to cut into." Considering the sharply defined body features of its head, thorax and abdomen, it is a very appropriate name. A term less commonly used, yet equally descriptive, is "hexapod"; this is derived from the Greek *hexapodos*, meaning six-footed, a characteristic of all insects. Close relatives of the insects, such as the spiders, ticks, mites, and scorpions, have eight legs, while their more distant kinfolk, the centipedes, millipedes, sowbugs, and other crustaceans are more generously equipped with legs.

Interestingly this large group, containing 750,000 or more known species, comprises fully 80 percent of all creatures known in the animal kingdom. For the most part they are very small animals, but it seems that what they lack in size is made up for in abundance. Even the ubiquitous honeybee, which averages about 3,500 individual bees to the pound and weighing ten pounds to the colony may represent 3,500,000 "winged workers" in a commercial bee-yard of 100 hives, yet such a bee-yard may occupy less than an acre of ground. Almost any large tree may be host to many thousands of aphids, whiteflies or scale insects; and yet their presence may escape notice. We are well aware of how grasshoppers, leaf-eating beetles, caterpillars, and others when abundant can cause serious defoliation to field or forest in a relatively short time. The total weight of these tiny creatures may well exceed that of cattle or other domestic livestock grazing in a similar area.

The insects which cause real concern are those which feed on our plants or transmit plant and animal diseases, or are annoying because of their presence. The honeybees, so necessary in the pollination and setting of our fruit and seed crops, and the ladybird beetles and others which aid in controlling the injurious insects are the ones which merit our protection and encouragement.

Much can be done toward protecting these friendly helpers even while waging warfare on the injurious kinds. When it becomes necessary to apply an insecticide it should be done early; that is, before there is appreciable injury to the plants, and while the pests are in their early stages of development. In general, insects are most susceptible at that time to various control measures; and too, the owner has the satisfaction of controlling the pests before they have caused noticeable damage. What's more, the beneficial insects which normally appear later will be spared. If spraying is done while the plants are out of bloom, it will go far toward preventing injury to bees and other pollinating insects.

While we consider ourselves fortunate in having various insect predators that prey upon the injurious kinds, it is unwise to depend upon them to do the entire control job; we must lend our aid. Often, because of unfavorable weather or other causes over which man has no control, the natural predators and parasites fail to become active until late in the season, after the plant damage is done. At best the natural agencies, valuable though they may be, do only a partial job of pest control. For this reason, if none else, the operator must do his part by the use of timely spraying or other applied control measures to obtain the protection the plants require for proper growth and development.

In the use of any pesticide it is wise to follow the manufacturer's instructions on the label. Be guided by his instructions, and use a good sprayer or duster. Of the various types of applicators in use, the garden-hose spray gun has become increasingly popular because of its convenience, efficiency, and simple construction. Whether it's a sprayer or

duster, the applicator should be cleaned after use and stored in a dry place; this will guard against corrosion of its working parts and greatly lengthen its period of usefulness. Another precaution to observe is to keep all pesticides stored in a locked cabinet where they are out of reach of children and pets. Such chemicals are poisonous and should be plainly labeled.

Along with the development of new and increasingly effective pesticides of late years, there has been a multiplicity of trade names appearing. The *1963 Pesticide Handbook* contains 9,487 such names relating to insecticides, fungicides, herbicides, rodenticides, and other pest control preparations. As this listing is admittedly incomplete, the total number of pesticides on the market in this country may be well above 10,000. The situation is very confusing to the user who is faced with making a selection of a pesticide unless he follows the policy of being guided by the table of contents on the label instead of the trade name on the container. Actually the number of chemicals involved in the manufacture of pesticides is few in comparison to the number of trade names in common use. Until the manufacturers adopt a policy of pooling their advertising and using similar names for similar pesticides, the situation can become worse instead of better.

DUTIES OF THE ENTOMOLOGIST

Necessarily, research on insects affecting ornamentals receives major attention. Other activities of the entomologist include teaching, outlining plant protection measures, and identifying insect specimens submitted by the staff and general public.

Regarding research, we may think of it as the key that aids in revealing the answers to problems. It is a never-ending quest since the answer to one problem usually leads to or throws light on another, thus blazing the trail toward better understanding of things to come. A problem in entomology that has been under investigation of late at the Arboretum has dealt with control of the small moth larvae responsible for causing galls on the twigs and flowers of *ceanothus*, a native ornamental shrub, sometimes referred to as mountain lilac because of its lilac-like clusters of flowers. In addition to revealing the biology of the pest, *Periploca ceanothiella*, the study showed that the young larvae, while in their active feeding stage, can be destroyed by the timely application of a foliar spray, using the recently developed systemic dimethoate (Cygon). A single application of this insecticide in late June, when the new generation was beginning its feeding activities within the plant tissue, resulted in a 92 percent mortality of the gall larvae. Of particular interest was the fact that the insecticide spared the beneficial parasites, thereby aiding further in controlling the pest. Observations indicated that the parasites escaped injury because they attacked only the mature gall larvae, which had ceased feeding before the spray application and therefore could escape the lethal effect of the insecticide. The same insecticide is being tested against other "hard to control" insects in the interests of developing increasingly effective measures against such insidious pests.

The study showed that this gall-forming insect was quite selective in its attack on the *ceanothus*. Examination of some 40 kinds of these flowering shrubs growing in mixed collections at several southern California locations showed only *Ceanothus griseus* and *C. griseus horizontalis* to be heavily infested, while the others showed only moderate to light or no injury at all; this suggests the use of non-susceptible varieties insofar as practicable to avoid or alleviate this gall insect problem.

Other pests which lead a hidden existence within plant tissue and are difficult to control with ordinary insecticides are the leaf miners. These insects "mine" between the upper and lower leaf surfaces of various plants to cause serpentine or blotch-like damage to the leaves. Such injury is disfiguring and often results in a heavy leaf drop.

This year, at the outset of leafminer injury to the large sycamores growing in the

Sunset Demonstration Gardens of the Arboretum, it was decided to test the same systemic, which had proven so satisfactory for checking the gall insects on ceanothus. Accordingly a foliar spray consisting of one pint of the Cygon to 100 gallons of water was applied; within hours it had controlled the infestation and the minor injury ceased. An important precaution to observe with this insecticide is to use it at no heavier rate than approved by the manufacturer. Heavier concentrations are liable to cause phytotoxicity or severe burning of the foliage.

From the many specimens referred by home-owners and others daily, a reference collection is being assembled. As yet, this collection consists mostly of specimens together with examples of their injury displayed in glass covered mounts. The collection serves a dual purpose: it aids in making identifications as well as being useful in the preparation of educational exhibits.

Teaching of a course in entomology which stresses plant protection is given annually for the students in the professional gardening school at the Arboretum. The course deals with the development, life habits, and seasonal occurrence of the more important species, together with notes on their control. In cooperation with the Children's Education Section of the Arboretum a field trip on insect-plant relationships has been organized for grade school students. The students, accompanied by their teacher, come in from various parts of the county by bus. They are met upon arrival at the Arboretum by an Information Aid and conducted on a one hour lecture and demonstration tour relating to this interesting subject.

An observation hive of bees and the Comstock collection of butterflies, moths, beetles, and other arthropods now housed at the Arboretum aids greatly in this instruction. The observation hive is continuously on display in the Arboretum rotunda for all visitors: similar glass-walled hives are also on display in the Museum of the Children's Education Section at the Arboretum, and the Garden House of Descanso Gardens in La Canada.

The observation hives are designed to be as self maintaining as possible and seldom need special attention. At the outset, some difficulty was experienced because of the abnormal amount of daylight entering the hive through its glass sides. This was remedied by the use of "drop-doors" which promptly closed down over the glass to exclude the light following each inspection. Another problem was represented by the colonies inability to withstand winter temperatures; this was remedied by an electrical heating unit located underneath the hive. Such observation colonies have permitted many thousands of visitors of all ages to view the bees at close range in perfect safety and see their activities of brood-rearing, comb-building, pollen-carrying and means of communications by the so-called "bienen ballet" or bee dances described by the famous Karl von Frisch.

The Comstock collection of moths, butterflies, etc., has proven to be especially useful. It demonstrates the role of mimicry and warning colors as protective means in certain species, the adaptation of form to function and the distinguishing characteristics of representatives of this enormous phylum or group. The collection was assembled from many countries of the world over a 30 year period by Dr. John A. Comstock. The glass covered cases holding the pinned specimens of this collection are mounted on portable tables which permit the displays to be moved about in the lecture hall as required. The exhibit is used to particular advantage in the teaching of the youth groups.

PLANT PROTECTION

In this 130-acre expanse of Arboretum which receives about 1,200 visitors per day, it is particularly important that tree, shrub and plant pests be kept at a minimum at all times. Such pests are not only annoying because of their presence, but can spoil the

appearance of the flowers and foliage, and can be very injurious to the plants. Constant vigilance, timely spray applications, pruning, cleanup, and cultural practices by the arborist, crew, and the gardeners have satisfactorily kept the various pests in check. The insecticides used are carefully considered from the standpoint of effectiveness in destroying the more injurious pests and yet representing the minimum danger to birds and other beneficial forms of life.

The effect of the pesticide on the foliage or plants must also be considered. Some are phytotoxic. An example of this is DDT, which while harmless to most kinds of plants, is injurious to an occasional plant. At Descanso Gardens where thousands of camellias are grown, in the shelter of the huge oak trees, spraying must be done annually to protect the oaks from caterpillars and other pests. An economical and highly effective pesticide is DDT, but it must not be employed because the drip or drift causes injury to some camellia varieties. As a result, other insecticides such as zectran, or a malathion and toxaphene combination (Malphene) are used instead.

Because of the many species of insects which attack trees, shrubs and plants, it is most convenient to consider them according to their feeding habits. There are the sap-suckers, the leaf-eating caterpillars, the twig-girdlers and bark-beetles, the wood-borers, the leaf-miners, the gall-forming insects, and the soil inhabiting pests such as cutworms, mites and snails. The entomologist receives many calls on what to do about swarms of bees getting into the walls of houses or chimneys, or how to get rid of bark gnawing rodents, or how to keep birds away from berry patches. Some of these inquiries are such that they must be referred to pest control operators or others who constantly deal with such problems.

The sap-suckers: These live on the "life blood" of the plants, shrubs and trees. They include the aphids or plant lice, the mealy-bugs, white-flies, psyllids and scale insects. They are all equipped with piercing and sucking mouth parts. In addition to sucking the plant sap most of these insects excrete a sticky "honeydew" which often results in an unsightly, sooty colored, fungus growth that spoils appearance of the foliage affected. Application of a good insecticide, such as malathion, lindane or zectran at the first indication of this type of injury not only gets rid of the insects but prevents the sooty fungus growth.

In addition to robbing the sap and detracting from the appearance of the foliage some of these insects, especially the aphids, are spreaders of virus diseases among the plants. Inasmuch as they are sap-suckers there is the possibility of getting highly effective control by the application of a systemic type of insecticide, such as dimethoate (Cygon). Such an insecticide is absorbed almost immediately into the sap and results in killing many kinds of pests which feed on the sap or sap-saturated plant tissue. Such a systemic is especially desirable for use on ornamentals.

The leaf-eating caterpillars represent a wide assortment of pests which devour the foliage. They feed only as larvae, or caterpillars, a period which is seldom more than a few weeks duration; but, long enough to cause serious defoliation to oak, elm, willow and many other kinds of shade and ornamental plants. Usually, an occasional defoliation does not kill plants outright; but, such defoliation causes setbacks which can be avoided by well planned spray programs. Prompt application of the insecticide at the first sign of infestation, using spray equipment that will distribute the spray into the topmost foliage is essential for effective results.

While the selection of the insecticide for a particular purpose is important, the timing of its application is equally so. Little is to be gained by spraying too soon or too late. If applied too soon, the residual effect of the spray is liable to be dissipated before the

larvae appear; or if applied too late, it may represent largely a waste of time, effort and money. The ideal time to spray is shortly after the eggs have begun to hatch and before the larvae have caused appreciable damage. The young larvae are much more susceptible to the spray at this time, and such control represents prevention of injury, which is the ideal objective. DDT applied as a spray is one of the most economical and effective insecticides for the leafeaters, but has its limitations in that it is rather ineffective against the sap-sucking insects and mites. Other valuable insecticides include zectran, sevin, DDD, or a mixture of malathion and toxaphene. Such pesticides as malathion-toxaphene mixture (obtainable under the tradename of Malphene-D) or the newly developed zectran are employed to advantage when aphids and mites are also present.

The twig girdlers and bark beetles: Probably the most troublesome in this group is the oak twig girdler, *Agrilus angelicus*, responsible for the dead and yellowish clusters of twigs or branch ends so conspicuously showing among the greenery of the oaks. The larvae of this beetle feeds directly under the bark so as to make rather spiral-shaped galleries or tunnels. These shut off the flow of sap, thus resulting in the dying branch or twig ends. Somewhat similar injury is caused to birch, poplar, and other trees by related pests. Control of the twig-girdler may be secured by the application of DDT, BHC or lindane sprays applied in May or June following emergence of the beetles. Inasmuch as this species has a two-year life cycle, it will require several annual spray applications to bring about effective and complete control. Removal of the unsightly girdled twigs is recommended where it doesn't involve too much labor.

Wood borers: This group represents a fairly large number of pests including the moth larvae such as carpenter worms, peach tree borers, sycamore borer and the beetle larvae commonly referred to as round or flat-headed borers. Their injury to the tree or shrub may be either feeding under the bark or boring deeply into the wood. The application of DDT or other residual type of spray as suggested for controlling the twig girdlers is also used in combating the wood-borers. Such sprays, however, are seldom employed especially for borer control as they are only partially effective. Keeping the trees and shrubs in a healthy and vigorous condition by adequate watering, fertilizing and pruning will aid greatly in warding off the borer trouble, or at least in helping the trees withstand this type of injury. Where only an occasional tree is affected by borers, it is usually most practical to treat the tunnels with a few drops of liquid fumigant. The fumigant may be conveniently injected with a small oil-can; afterwards closing the tunnel opening with mud or other filler to confine the fumes. Effective control of the peach tree borer may be obtained by sprinkling from one to three tablespoons of "moth crystals" (paradichlorobenzene) around the base of the tree and mounding to a height of about one foot with soil in early fall when the borer injury begins. The amount of crystals to use will be somewhat proportionate to the size or age of the tree being treated. A few weeks is sufficient for the tree's exposure to the fumes. Afterwards the mound should be removed. Another means of dealing with borers is to cut away the damaged bark and remove the larvae. Sometimes the larvae may be destroyed by probing the tunnel with a wire.

The leaf miners represent mainly some moth and beetle larvae which devour the tissue between the leaf surfaces. Such injury is harmful to the growth of the plant, shrub or tree and detracts from the appearance of the foliage. Prior to the development of the systemic type of insecticide, little could be done to control such feeders. With the introduction of the systemics such as dimethoate, however, the opportunity for satisfactory control has been greatly improved. Prompt insecticidal application at the first indication of injury is important; besides killing the larvae already present in the leaves, the insecticide leaves a lethal residue in the tissue that remains effective against the

insects for a period extending up to three weeks.

Gall forming insects: These include hundreds of species, mostly the wasp-like cynipids which cause the many different types of galls or swellings on leaves, twigs, buds, roots, and other plant parts. In addition to the cynipids there are other gall formers including certain species of aphids, beetle and moth larvae, flies and mites. Interestingly, each species of gall insect produces its own characteristic type of gall, often so dissimilar to others that an experienced observer can identify the species by the appearance of the gall. As with the leaf miners, the gall-forming insects are protected within the plant tissue and are practically impossible to contact with the usual type of insecticide. Indications point, however, to the systemic dimethoate as a possible answer to the problem. Here at the Arboretum we have used this insecticide successfully in controlling the ceanothus stem galls; its further use against others that encyst themselves within the plant tissue awaits the results of testing and observation.

The soil-inhabiting forms include a wide assortment of pests of lawns and garden plants. Possibly of greatest concern are the cutworms, vegetable weevil, grubs, ants, snails, slugs and mites. Timely application of the new zectran insecticide has given good control of all these pests. Where insects are the problem, usually the application of DDT, dieldrin or chlordane will give the control required. Metaldehyde dusts and baits, available on the market under the trade names of Snarol, Slugem, Bait, Slug-Kill, etc., are often used when slugs and snails are the only problem.

On golf courses and similar grassy places the frit fly larvae are occasionally injurious to the plants. They feed on the young stems and when abundant cause severe injury to the plants. Diazinon spray is used effectively against them.

Such pests as gophers, ground squirrels and various other rodents are at times troublesome, particularly in the larger plantings. A 50-page publication entitled "Controlling Field Rodents in California," Circular No. 434, discusses this subject fully and may be obtained by writing the University of California Agricultural Experiment Station, Davis, or by contacting your Farm and Home Advisors Office, which for Los Angeles County is at 808 North Spring Street, Los Angeles, California. Another excellent publication is "Ridding the Garden of Common Pests," Circular No. 479, and many other related publications are obtainable from the same sources. They are yours for the asking.

While the "green thumb" often gets the credit for the many fine lawns and gardens to be seen in most communities, there is a tendency for some of us to think lightly on the many things that go to maintain plantings in the healthy and vigorous condition we like to see. Plants require protection from pests and disease; they need cultivation, watering, fertile soil, and freedom from weeds; some plants fail for the lack of some trace element. All these things and more may be thought of as the links of a chain. If any link is weak or inadequate it will reflect adversely on the condition of the plants. Plants require all-around care, whether it be the timely application of a pesticide, tree pruning, or the elimination of weeds; all such things must be observed to keep the plantings looking their best. To do this well requires attention to many details and a sound background on the requirements of plant growth.

Judging by the wide assortment of specimens brought to the Arboretum for identification and requests for suggestions on dealing with the problems they cause, it is evident that people are showing a keen interest in the plants which add so much to the beauty of their homes and landscape. This situation is encouraging and in keeping with the Biblical observation that "man does not live by bread alone." For our peace of mind and well-being, it seems that we must devote a fair share of our time and effort to the ornamentals. Even though they may have little or no direct relationship to food, fibre, and forage production, they are morale boosters and of value from the esthetic standpoint.

The Palms of Lord Howe Island

CHARLES A. HALLBERG

Out in the Tasman Sea is a garden island called Lord Howe Island in honor of Richard Howe. He was a British Admiral who played an important part in the war with the American Colonies. This garden island lies 360 miles east of Australia and 480 miles northeast of Sydney. It is shaped like a boomerang, with its length extending nearly north and south. There is a broad coral reef around Howe Island that is the southern-most coral reef in the world.

The island has plenty of fresh water and very fine soil. Frost never finds this garden island, nor does the heat. You can grow everything that grows in warm temperate and sub-tropical countries, with the exception of those palms which are heat-loving palms.

Howe Island is the home of the *Howea Palm* (*Howea forsteriana*) and the *Howea belmoreana*, both named in honor of Lord Howe. They were first known as the *Kentia Palm*, but botanists say they are different from the true *Kentia* of New Guinea.

The residents that live on this island depend on the palms for their income. The affairs of these people are handled by a local Committee of three chosen by the islanders themselves. The marketing of the Palm seeds, and relations with the Australian Government are directed by the Lord Howe Island Board of Control. This board is composed of three New South Wales officials in Sydney. The island is a political dependency of that State.

The people that collect the palm seeds pay no taxes on the property, as the collecting of the palm seeds is a community affair. The work is apportioned among the participants by the Local Committee. Each one is called on to provide his share of the estimated seed total at such times as the committee directs. It takes about an hour to gather one bushel of seeds. The revenue from the sale of the seeds is placed in a common fund and is divided evenly in accordance with the share system depending on the age, sex, and marital status of the people gathering the seed.

The *Howea* palms grow well along our coast from San Diego to Santa Barbara. They can be grown inland in our area if given the shade of high evergreen trees, and these same trees will protect them from frost.

Other forms of vegetation that grow on the island are *Pandanus* trees and Norfolk Island Pines. This is truly a gardeners paradise.

BOOK REVIEW

J. W. STEPHENSON

Mathias, Mildred E. and Elizabeth McClintock. *A Checklist of Ornamental Woody Plants of California*. Manual 32. 65 pages. Berkeley, California: California Agricultural Experiment Station Extension Service. April 1963. 75¢. (paper). (Available from your Farm Advisor, or Agricultural Publications, 207 University Hall, 2200 University Avenue, Berkeley 4, California.)

For the correct names of our woody garden plants, most nurserymen and amateur gardeners, landscape architects and others, use reference works now more than twenty years out of date. Thanks to the painstaking efforts of Dr. Mathias and Dr. McClintock, order has been brought out of a chaotic situation. Their work is of both academic and great practical value.

The Manual is inexpensive enough for any gardener to own, and is an essential reference for every nurseryman. It is easier to use than most checklists I have seen, since the common names and botanical names are listed alphabetically, AND the improper terminology is clearly indicated. The authority for each botanical name is given, so there can be no confusion as to the species, even though such detail is not required by the revised Nursery Code. It will be useful to every plant-owner, from tyro to botanist.

PASADENA GARDEN CLUB FOUNTAIN

The Pasadena Garden Club and its members have for several years participated actively in the rehabilitation of the Historical Center of the Los Angeles State and County Arboretum. With Garden Club funds, landscaping to recreate a Victorian garden around the "Queen Anne Cottage" was accomplished.

As a Pasadena Garden Club project for the spring of 1963, with Mrs. James T. Wood, Jr., Miss Abigail von Schlegell, Mrs. Gordon K. Smith, Mrs. Richard W. Millar, and the late Mrs. Earl E. Crowe on the selection committee, a fountain has been installed to give new interest and water movement to the otherwise still pool in front of the "Queen Anne Cottage". All electric connections and pool refurbishing was also included in this gift to the California Arboretum Foundation, Inc.



The Eucalyptus Crusade

VIOLA LOCKHART WARREN

Reprinted from the *Southern California Quarterly*, the publication of the Historical Society of Southern California, XLIV (March 1962), 31-42.

The mere outline of a eucalyptus tree against the horizon serves to identify California to the rest of America, because our state almost alone has the tree, and we have it in fantastic abundance. It is easy to forget that Southern California, now so well clothed with eucalyptus, was once almost barren of any kind of a tree. No forests grew here: only tangles of willows along the stream beds, sycamores in the deepest canyons, and live oaks on the moist side of a few coastal hills. A single isolated stand of Torrey pine thrived in the dampness of the southern coastline, and a ragged clump of native palms struggled in a hidden canyon near Palm Springs. The rest of the arid land accommodated only chaparral, cactus, and wild mustard.

The Franciscan missionaries were the first to rebel against the absence of trees. They brought pepper trees from Spain to shade the Mission courtyards, imported fruit trees, and encouraged the olive to grow on their irrigated lands. The natives of Los Angeles were slower to plant trees, because the only water available to the pueblo ran from the Los Angeles River in narrow, weed-grown ditches, or was carried to the householder in a barrel on a donkey cart. As late as 1840, the pueblo could boast only two large trees: a lofty and wide-branching pepper tree in front of a Mexican adobe north of the Plaza, and a giant sycamore in front of the winery of Don Luis Vignes on Aliso Street. When a flagpole was needed in 1850 to furl the first United States flag over Los Angeles, it was necessary to send a crew of Indians to the pine forests of the San Bernardino Mountains to drag back two pine trunks.

In 1855, the School Trustees of Los Angeles bought a dozen or more black locust trees at "eight bits each" and had them planted on the school grounds. The schoolmaster watered them so faithfully from the school barrel that the water carrier protested to the Trustees about the waste of water. In the ensuing controversy, only a few of the locust trees were saved, the only trees growing on city land. The old Plaza and the vacant area then known as Central Park, now as Pershing Square, were bare of trees until 1870. Meanwhile, the drastic need for firewood was reducing the scant supply of willows, sycamores, and oaks, and was even destroying the peppers and olives in the abandoned Mission gardens.

Eventually, the ranchers introduced walnut trees by importing seeds, brought almonds from the Mediterranean, and chestnut seeds from Bourdeaux, France. It became a delightful custom in the pueblo to share a small packet of imported seeds with friends and neighbors, and then to compete for the best stand of the foreign trees. Large fruit orchards were finally cultivated successfully on the River bank, or in nearby areas where the water of small streams could be impounded for irrigation. Home gardens began to display exotic trees brought by sailing vessels from far-away lands. The welcome shade of trees was deepening in the settled communities, but the vast empty plains and the rounded hills were still sunburnt and sterile, waiting for the eucalyptus crusade.

The crusade started in a small way in San Francisco immediately after the gold rush, when Dr. H. H. Behr, a native of Germany and a pupil of Alexander Humboldt, began to talk about the importation of eucalyptus and acacia from Australia. He may have sent away for the seeds. At any rate, by 1853, there were fourteen species of eucalyptus growing in the garden of a Mr. Walker, of San Francisco. Hayward had a large planting in 1856, and in 1860, Stephen Nolan, a nurseryman of Oakland, had seedlings ready to

sell to the public. In Southern California, William Wolfskill planted eucalyptus on his Santa Anita rancho sometime after 1859. A cluster of five trees was still standing there when Harris Newmark bought the ranch in 1873.

The very name "eucalyptus" was a curiosity to the people of California. The combination of two Greek words, suggested by the formation of the seed pods, might be translated, "I conceal well," or "well hidden." The tree itself, an evergreen, with smooth bark, long graceful branches, and blue-green foliage, was an even greater curiosity. Single seedlings were planted experimentally in home gardens all over the state, with high hopes for ornamentation and shade.

For a dozen years, the planting of eucalyptus continued to be sporadic and experimental, until a modest educator, president and principal of the small, private Santa Barbara College, started a crusade with his plea that a barren state be converted into a continuous forest of eucalyptus trees. Ellwood Cooper had seen eucalyptus trees in San Francisco when he first arrived from the East, and he determined to plant some on his Dos Pueblos ranch, twelve miles west of Santa Barbara. Taking advantage of previous acquaintance with Thomas Adamson, Jr., United States Consul-general at Melbourne, Australia, Cooper wrote to ask how to obtain some eucalyptus seed. He also asked about books on the cultivation of the tree, because he could find none in America. Mr. Adamson sent the seeds and reported that Baron Ferd von Mueller, a botanist stationed in Melbourne by the British government, had delivered some lectures on the subject. The lectures had been printed, but the copies had all been sent to the government in London. However, Baron von Mueller would send his one precious original to Mr. Cooper, provided Mr. Cooper would have it published in America and give the Baron fifty copies.

By this devious and thoroughly academic process, Ellwood Cooper got his seeds, read all about their culture, and began to plant. His first trees were three years old, and the little College which his three children attended, and where he had accepted leadership responsibility, was five years old in 1875. When the officers of the College asked their president to be the speaker at a benefit to raise money for the college library, Ellwood Cooper fused his two absorbing interests into a lecture entitled, "Forest Culture and Australian Gum Trees."

Although Cooper had read all of Baron von Mueller's hyperbole about the eucalyptus as a money-making proposition, and although he did stimulate his audience gently with visions of income from trees, yet his heart was obviously in the more aesthetic and patriotic aspects of eucalyptus culture. He decried the wanton destruction of the forests in the eastern part of America and in Europe, and pled for their replacement by the planting of new forests of eucalyptus trees in California.

The preservation of forests is one of the first interests of society, and consequently one of the first duties of government. All the wants of life are closely related to their preservation; agriculture, architecture, and almost all the industries seek therein their aliment and resources, which nothing could replace. . . . Their existence is of itself of incalculable benefit to the countries that possess them, as well in the protection and feeding of the springs and rivers, as in their prevention against the washing away of the soil upon mountains, and in the healthful influence which they exert upon the atmosphere.

He promised his listeners joy in the planting. "It may be questioned whether, in the whole range of rural occupations, one more interesting presents itself than the superintendence of a growing wood, presenting to the eye at every season new objects of interest and solicitude. Where is the planter who would wish the workmanship of his hands undone, and who does not look with honest pride on the beautiful creation which, in a generous spirit, he has raised up around him?"

Ellwood Cooper could speak with authority on the gratifications of the planter, because he now had 50,000 eucalyptus growing at Ellwood, his home ranch. Some were on steep hillsides, some on level ground. Some were cultivated, some not. Some had irrigation, some had none. Every species was identified, and the rate of growth of each recorded. He could tell his audience that a tree grows to forty-five feet in three years from seed, with a diameter of nine and a half inches; that young trees reach six feet in five months. He could explain exactly how to propagate the seeds and how to transplant into the open ground, "as easily as setting out cabbage plants." Most persuasive of all, he could describe an acre of land planted with trees six feet by seven feet apart, one thousand trees on the acre. At the end of five years the planter takes out three fourths of the trees and sells them for 700 fence posts and fifty cords of firewood. The remaining trees become so valuable at the end of fifty years as to return 100% on the investment. "What we have therefore to do, as individuals, is to begin at once to plant. It is an obligation we owe to the possessory title to land; and financially we will be amply rewarded for our labors."

President Cooper's address to the little group in Santa Barbara stirred up so much interest that he was persuaded to publish his material. In his little book of 1876, he fulfilled his promise to Baron von Mueller by including a large section of the Baron's writings: his definition of species; his discussion of industrial uses; his description of the Australian eucalyptus. The book devoted a chapter to a listing of twenty varieties of eucalyptus available from the plant catalogue of Anderson Hall & Co., of Sidney, Australia, and at the very end of the book, as if by accident, there was inserted the Fifth Annual Catalogue of the Santa Barbara College.

With the naive mixture of patriotism and acquisitiveness which Ellwood Cooper had inspired, Southern California began to plant. At least, as good citizens, the planters would be serving their community, even if they never made money on fence posts or cord wood, and even if their eucalyptus trees were never used, as were those in Australia, for ships, bridges, piers, railroad ties, telegraph poles, wagons, furniture or any of the other hardwood objects that Cooper had enumerated. The nurserymen took advantage of the crusade spirit, collected seeds locally, and supplied seedlings in abundance. Cooper had recommended windbreaks planted at right angles with the prevailing direction of the wind, and windbreaks were planted. Cooper wanted the highways lined with trees, closely planted and two or three rows deep, and the inspired land holders edged their property with belts of little seedlings and watered them carefully for the first year. As they watched the trees grow, they came to agree with Cooper, "In its juvenile period, it is a finished type of elegance. In its adult period, it is a magnificent representation of strength."

When the State Legislature created the Board of Horticulture in 1883, Ellwood Cooper was made a member, without salary. He was still on the Board twenty years later when it was converted into a Commission. For four years more he served on the Commission. Of course, he carefully tended his eucalyptus grove at home while he carried his crusade into the state arena. In December, 1885, his good friend in Santa Barbara, Judge Charles Fernald, also an officer of the Santa Barbara College, joined the eucalyptus campaign by supplying seeds of a new species to horticultural societies and other agencies interested in forestry. The letter that went out with his little packets of seeds indicates the amateur character that still marked the eucalyptus crusade:

"I have received very recently from Mrs. Charles Hutton of Bath, England, a small package of the seed of the "Jarvah," the giant eucalyptus of West Australia, forwarded by the Manager of one of the estates of that lady in the last mentioned place. I desire

to distribute this seed as widely as possible throughout California, especially to the members of the various Horticultural Societies and to those who take an interest in 'American Forestry,' trusting that the noble and valuable tree may, in time, become acclimated and thrive here.

"I therefore take pleasure in sending herewith a small portion of the seed to you, which I beg you will accept, and distribute in such a manner as you may deem wise and proper for the accomplishment of the purpose above named.

"It has occurred to me to recommend the setting of young trees, if the seed should grow, in as many different soils, localities, and exposures as possible, until the habit of the tree shall be better known."

With good luck, Judge Fernald's seeds could probably have planted the entire state, because there are over 10,000 eucalyptus seeds in a single ounce. But the hazards in planting are many. A large proportion of the early seeds from Australia were sterile, this despite the fact that a fertile seed remains fertile for as long as six years, until it is moistened in a seed bed. More serious for Judge Fernald's dream of spreading the new species, correctly known as "Jarrah," was the fact that seeds from Australia were seldom true to name. Gathered by the natives in the Australian bush, the seeds might represent any one of the 150 species of the genus, or might be a mixture of many species.

Moreover, conditions of planting differed widely with the different species. Some required moist soil with the water table near the surface. Others could thrive on dry soil if they were exposed to ocean fog. No variety could tolerate frost in its early years, although some mature trees could withstand temperatures slightly below freezing. Excessive heat was fatal to some species, of little danger to others. Some grew easily in solitude, whereas they did not survive if planted closely in a grove. Some could be harvested early and would sprout again, other would not. Each species reacted so violently to its soil and temperature environment as to produce quite a different tree in each environment, some resembling neither their brothers in California nor their ancestors in Australia.

The resultant confusion in identifying species and in determining the special conditions for planting each, resulted in many failures with the seedlings and in growing discouragement with the idea of trying new varieties. The most generally successful species was the *Eucalyptus globulus* or "blue gum." Although it was not the tallest, nor the best for timber, it was the fastest growing; it would thrive easily under average conditions; it produced effective windbreaks and spectacular corridors along the streets and highways. It could be "cropped" every five years for fire wood and would sprout again for a new cropping. It would even seed itself, if the wind should blow its seeds into a hospitable spot. With the blue gum, then, in possession of the field, the crusade gathered momentum.

Patriotic school children planted blue gum on Arbor Day, especially in the north. The Presidio, Sutro Forest, Mount Davidson, and other public areas were planted almost wholly by school children. On a hot November day in 1886, 3,000 public-spirited citizens went by boat to Yerba Buena Island to plant blue gum while the First Infantry Band played background music, and such distinguished men as Mayor Sutro, Joaquin Miller, and General Mariano Vallejo gave them encouragement. The University of California campus in Berkeley was planted by a group of enthusiastic neighbors.

The Forest Grove Association was formed in Los Angeles in 1875, seeking "to convert the barren horizons into both beauty and profit by planting eucalyptus trees on a large scale." This group was interested in the experimental planting at "Santa Monica Heights," now Riviera Heights, and in converting Sullivan Canyon into a eucalyptus forest. The State Forestry Bureau built an experiment station in Santa Monica and, under the management of W. S. Lyon, Forester of the Bureau, tried many different species.

Closely associated with the Forestry Bureau, and its Chairman from 1886-1888, was a new apostle in the crusade, Mr. Abbott Kinney, better known as the founder of Venice and Ocean Park. While road master of Santa Monica in 1876, he had planted the streets of Santa Monica, the highways leading to the city, and his own home gardens in Santa Monica and in the San Gabriel Valley, with many different varieties of eucalyptus. As State Forester, he distributed seeds and seedlings throughout the state without charge, asking only that records be kept of their adaptation. He lectured widely, pleading for more intelligent utilization of the many diverse species of eucalyptus. Finally, in 1895, he published a monograph on the subject, describing again the different species and the special growing conditions and uses of each, wishing to "make the knowledge of the eucalyptus accessible to the largest possible number of inquirers."

To prove that variety in species is possible in California, Kinney gave the location of sample trees of fifty-one species, urging that these successful plantings be visited and reproduced in other areas. In addition to the value of certain species for timber, he stressed the use of other species for medicinal oil; tannin; kino or red rosin for insecticides and astringents; nectar for honey bees; paper pulp; bark for mats; moth balls; nest linings to control the lice; scouring material for encrusted boilers. Above all, he emphasized the ability of the eucalyptus tree to "draw water" and thus drain swampy land and reduce the incidence of malaria.

Mr. Kinney's enthusiastic but disorganized book is of value today chiefly for its precise location of the large plantations of 1895, and of the occasional trees of note in private gardens and on public streets. Almost invariably he found a good specimen of every species in the twenty-three-year-old planting of Ellwood Cooper in Santa Barbara.

But a more urgent incentive than Mr. Kinney's enthusiasm was necessary to keep the crusade rolling, and this incentive was provided in 1904 when the Forest Service of the U. S. Department of Agriculture announced that the supply of eastern hardwood would be exhausted in about sixteen years. As a result of the increasing scarcity and the rising price of oak, hickory, ash, walnut, maple, and mahogany, manufacturers of hardwood goods began to look for a substitute. Tests with Australian eucalyptus showed this hardwood to be the equal, if not the superior, of the accustomed eastern woods.

Here was a new and urgent reason for planting groves of Australian eucalyptus in California. A plantation set out immediately would be ready for cutting just as the eastern hardwood went off the market. The Panama Canal would be completed then, and lumber from California could be shipped at low cost all over the world. The eager planters studied again the list of species, decided which would produce the best hardwood for commercial use, and planted feverishly.

At least fifty nurserymen swung into action with seedlings; newspapers and periodicals carried encouraging and instructive articles; new industries were organized to process the timber and to make use of its by-products. A one-time Assistant State Forester, Mr. C. H. Sellers, published a book of "authentic data" for the guidance of the commercial planters. Its title was *Eucalyptus, Its History, Growth and Utilization*. Utilization was the key word in the treatise. The book was studded with testimonial letters from furniture makers, flooring firms, agricultural implement houses, dry dock builders, and other users of hardwood, all describing eucalyptus wood as excellent for their purposes. By-products were listed, with conjectures as to profit: some dozen medicinal and cosmetic products made from the distillation of the oil and resin (one Santa Monica firm distilled nine tons of eucalyptol a year); souvenirs such as pipe bowls and canes made from the highly polished wood; tannin, in vigorous use for tanning leather; a superior grade of charcoal; paper veneer; paper pulp; bee nectar, paving blocks.

For several years, tree planting became a commercial obsession. The Santa Fe Railroad planted a giant grove at what is now Rancho Santa Fe, and put in thousands of trees along their right-of-ways so that railroad ties could be cut at the spot needed. Furniture manufacturers bought land in California and planted it heavily. The Pullman Company planned to finish the interiors of their cars with the beautiful grain of the eucalyptus, and planted accordingly. Jack London planted 100,000 trees on the slope of Sonoma Mountain. Forty square miles of trees were set out south of Pismo Beach, between Highway 101 and the beach. Good agricultural land was ripped up for the planting of trees, which promised to be a more profitable crop than grain or beans. A coal mining company planted a grove on good land in Compton, expecting to produce strong timbers for shoring up the mine shafts.

Meanwhile, owners of some of the mature groves started to take their timber to market. The first difficulties they encountered seemed trivial and easy to overcome. The trees had to be sawed immediately after cutting, or the wood became too hard to work. Perhaps the wood was cut at the wrong time of the year—would it be easier to work if it was cut while the sap was flowing, or while the sap was not flowing? And should the lumber be cured in the sun, or in a kiln? Should the kiln use dry heat or steam heat? Everyone worked vainly to solve these "trivial" problems, but little by little it became painfully obvious that the problems were not trivial. Whenever cut, or however cured, the lumber was not satisfactory. It warped, twisted, checked, and even opened into huge cracks. A Nevada railroad reported that its railroad ties were perfect in every particular but one—not enough solid wood could be found between cracks for the insertion of bolts.

What was the difference between the Australian eucalyptus that had long been successful in the hardwood market, and the California eucalyptus of the same species? Remembering the wide limits of variation of a given species under different growing conditions, there could be a dozen answers. Possibly the superiority of the Australian trees was just a matter of age, but the California planters could not wait until their trees were a hundred years old to see if their timber had improved.

Sadly, the lumber mills shut down and the furniture factories moved back East. The planters counted their losses and figured how much they could salvage by cutting down entire groves for firewood. The pharmacologists withdrew their endorsement of eucalyptol as a valuable drug, and the cold cream, cough drop, and liniment factories closed. Only a few products retained the eucalyptol ingredient. Orchardists removed the eucalypts from their lines of fruit trees, because the surface roots of the shade tree stole water from the fruit. City maintenance crews cut down eucalyptus trees because their roots would go as far as a hundred feet in search of water, breaking water pipes and cisterns. As they grew tall, the shallow-rooted trees were apt to blow over on the city streets and their brittle branches sometimes dropped on pedestrians. The blue gum became anathema to subdividers, who began to specify in their deeds that no blue gum could ever be planted on any lot in the subdivision. Nurserymen still had eucalyptus seedling for sale, but, rather than blue gum, they were now smaller varieties, designed for ornamentation and for shelter from wind and sun. In preference even to these, the nurserymen recommended the new favorites, jacaranda and magnolia, which would take up less room in a land where there was no longer room to spare.

The crusade had come full cycle, back to its modest beginning in the home garden where one tree was enough. But in the forty years since Ellwood Cooper sounded the clarion call, the crusade had clothed a major portion of California with forest, relieving the monotony of the bare hillsides and uncultivated wastes. The great trees rose tall and stately on every hand. What matter if individual dreams of profit were disappointed? The State has been beautified, and that was the beginning dream of the crusade.

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Growing Cymbidiums in a Shade Garden

ERNEST HETHERINGTON

Vice-President and General Manager Fred A. Stewart, Inc.

PART I Cymbidium orchids are grown throughout the world in temperate areas such as Southern California. The native species came from the mountains of northern India and adjacent areas. These cool-growing terrestrials (plants that grow in soil) put out a great amount of growth each year, compared to other orchids. Cymbidiums will stand considerable summer heat, though they must be given cool nights during late August, September, and October to make them flower. This condition occurs naturally in southern California. You may grow cymbidiums in sheltered areas in your garden if they are protected from frost. Southern, western or eastern exposures are best. A lath-house, saran screen house, or filtered light area under a lightly leaved tree is good. If you are in an especially hot, dry area, pots may be plunged in sawdust to half their depth, with additional bark or sawdust mounded up around the pot to retain moisture. In relatively frost free areas, cymbidiums can be grown directly in the ground in shady locations, though you get best results in containers.

In California and similar mild areas, cymbidiums may be grown out-of-doors and will withstand down to 28°F. without serious damage. If you are in an area where temperatures go below freezing in winter, a glassed-in porch, greenhouse or a cool, bright room is fine, provided the minimum night temperature is not too high. 50°F. to 60°F. minimum is best. Buds may drop if the temperature is kept over 60°F. at night. Polyethylene plastic film makes an excellent temporary winter cover where moderate frost protection is needed.

To be Continued Next Issue



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LASCA LEAVES

The official publication of the California Arboretum Foundation, Inc.

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LOS ANGELES STATE AND COUNTY ARBORETUM

Operated by

LOS ANGELES COUNTY DEPARTMENT

of

ARBORETA AND BOTANIC GARDENS

Box 688

Arcadia, California

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COVER PICTURE

"Heart of Flame," (*Bromelia balansae*)
Shrub to 3 feet, from Paraguay
111 ©Calif. Arboretum Found., Arcadia, Calif.

Here is your gift sample of the attractive and original Christmas cards now for sale by the California Arboretum Foundation at 301 North Baldwin Avenue in Arcadia.

CALIFORNIA ARBORETUM FOUNDATION NEWS

"The Arboretum Story" is being told in many ways including a color film made by Forrest Le Barron with Frank Simerly as Technical Adviser which was previewed complete with sound at the recent Board of Trustees meeting. With professional narration and musical background, the film beautifully depicts many of the varied activities of the Arboretum. At the regular bi-monthly dinner meeting on Tuesday, September 17, the Board announced that the film is now available for showing by members of the California Arboretum Foundation.

To spread the Arboretum story, the motion picture may also be borrowed by garden clubs, service organizations, and cultural groups. When not in use by Arboretum classes, the sound projector and screen may also be loaned to qualified operators on reservation. For further information phone the Gatehouse number HI 6-8251 or MU 1-0109.

The Orchid Print Sale was successfully completed with the help of the Social Committee under Mrs. Rudolph Richards, and the annual autumn Tour of the Arboretum the following week brought another gay reunion of the Foundation Membership. Now we look forward to the Preview of the Fall Flower Show on Friday evening, November first, from six to nine o'clock, in the Lecture Hall.

Friday, November twenty-second, is the date for the first of three evenings arranged by the Foundation Lecture Committee. It will feature Dr. Yale Dawson whose subject is "Cactus and Giant Tortoises of the Galapagos" at 8 p.m. in the Lecture Hall. Other lectures are scheduled for January and April.

This year there will be a special surprise when Foundation members and their guests assemble at the Reid Adobe for the eighth annual Christmas Posada at five o'clock. Be sure to save the date: Sunday, December 15. As in the past, youth groups from the Arboretum neighborhood and the Creative Arts Groups will cooperate on this colorful custom.

The Los Angeles State and County Arboretum on Saturday, October 12 presented a complete lawn show for the home owner from 9:00 a.m. to 4:00 p.m.

Dr. Williams, of the Arboretum staff, and Wayne Morgan, of the Farm Advisors office were assisted by students of California State Polytechnic College of Pomona, in showing how various home lawn problems should be handled. Many problems were demonstrated—removal of thatch or turf, renovation of lawns, new planting, overseeding, uses of sawdust mulch and winter grass, application of herbicides for weed control, and even dyeing of grasses for winter color. The students showed how to repair plastic pipes and sprinklers, and were in charge of the automatic sprinkler displays.

* * * * *

THE DESCANSO GARDENS GUILD Fall Calendar includes instruction on the preservation of leaves in glycerine, a preview of the Fall Chrysanthemum Show, a class on wreath and garland making, and Christmas Carols at the Hospitality House Stained Glass Window. The route of the proposed Freeway continues to be a matter of grave concern to all who wish to see the Gardens spared this intrusion.

* * * * *

SOUTH COAST BOTANIC GARDENS FOUNDATION will be hosts to the quarterly meeting of the Board of Governors of the Los Angeles County Department of Arboreta and Botanic Gardens on Tuesday, October 15. An outstanding library gift from Mr. George R. Martini is presently in the care of Foundation President Frances Young. It will go to the Botanic Garden as soon as a building is ready.

CALENDAR OF EVENTS

OCTOBER

- Thursday, October 3 Orchid Print Silent Auction Sale
6:00 to 7:30 P.M. Lecture Hall
- Monday, October 7 Fall Arboretum Tour for Members and Guests
9:30 A.M. Meet in Lecture Hall
- Saturday, October 12 Arboretum Lawn Show

NOVEMBER

- Friday, November 1 California Arboretum Foundation-Pasadena Star News
Fall Flower Show Preview
6:00 to 9:00 P.M. Lecture Hall
- Saturday, November 2 Fall Flower Show
- Sunday, November 3 Open to the public at no charge
- Friday, November 22 "Cactus and Giant Tortoises of the Galapagos"
A lecture by Dr. Yale Dawson of U. S. C.
8:00 P. M. Lecture Hall
- Friday, November 15 Southland Orchid Show
- Saturday, November 16 Lecture Hall and Seminar Room and
- Sunday, November 17 Orchid Houses

DECEMBER

- Sunday, December 15 "Las Posadas"—a Christmas Fiesta
5:00 P. M. Hugo Reid Adobe

JANUARY

- Monday, January 6 Winter Arboretum Tour for Members and Guests
9:30 A. M. Meet in Lecture Hall
- Friday, January 24 Western Division National Shade Tree Meeting
8:00 A. M. to 5:30 P. M.
- Friday, January 24 "Plant Collecting in New Guinea"
A lecture by Dr. George Kennedy of U. C. L. A.
8:00 P. M. Lecture Hall

FEBRUARY

- Tuesday, February 11 C. A. F. Day at the Races
Santa Anita Race Track

First Sunday of each month: Bird Walk 7:00 to 9:00 A. M. Meet at Gatehouse

A New Turfgrass Center for Southern California

H. HAMILTON WILLIAMS

The tremendous ingress of new residents to Southern California creates a great demand for living areas. A tabulated daily addition of 590 workers along with 510 children of school age would substantiate an estimate that by mid-1965 the population of California will be over eighteen and a half million. Whereas a portion of these new residents will settle in apartments, many will crave the house with a beautiful lawn. Some will be forced to settle for a tract home with a hastily prepared lawn that will soon present all types of cultural problems. Some will acquire spacious home grounds in suburban areas.

Trends in our economic development indicate a decrease in the length of the average work day. Consequently many more hours of leisure time may be anticipated. It may be assumed that no little part of these hours will be spent in activity involving turfgrass. This would include the care of the home grounds where the upkeep of the lawn is a major item, as well as the recreational activity in parks, playgrounds and golf courses.

In a 1954 survey, Dr. Vernon Stoutemyer (5) determined that there were more than 63,000 acres of turfgrass in Los Angeles of which 54,000 acres were in home lawns. There were also 3,100 acres in golf courses and 500 acres in parks and athletic fields. At that time this represented an investment of over 750 million dollars with an annual maintenance budget of about 250 million dollars. John Stark (5) states that at least 19,000 acres of land in the Los Angeles area have been designated for new parks and playgrounds to be developed within the next few years. This will involve an investment of some 26 million dollars for purchase of land and subsequent improvements. Mr. Stark has also calculated that by 1965, turfgrass areas in Los Angeles County alone will equal a green carpet 330 feet wide extending from Los Angeles to New York.

Since its inception in 1947, the Arboretum has been keenly aware of the importance of the community aspects of turfgrass culture. Dr. Louis Martin (7) of the Arboretum staff began the first research lawn plots here in the summer of 1950. The program was designed to determine grasses and grass combinations which would provide year-round green lawns under Southern California conditions of prolonged warm growing seasons and drought. It was recognized that the home owner needed a place where he could observe these grasses growing under a variety of conditions and determine which ones would be suitable for his particular lawn. Also it was felt that the Arboretum could well serve as a center for the accumulation and dissemination of information on turfgrass culture for the general public. The aesthetic appeal of well-cared-for grass areas as an inspirational factor was not overlooked.

The first grasses that were cultivated in the new plots were the Bermudas and the Zoysias. Observations on the behavior of these two grasses and their individual varieties and strains was reported in LASCA LEAVES for the Autumn of 1953. As will be reported later in this article, these two grasses remain in great favor and demand.



Entrance to the turfgrass research and demonstration areas.

On June 6, 1960 (6), Dr. William S. Stewart, Dr. Louis B. Martin and Mr. George Spaulding of the Arboretum Staff met with Mr. Richard G. Maire and Mr. Wayne C. Morgan of the University of California Agricultural Extension Service and decided that because of the size of the turfgrass industry and the great general public interest in lawns, an Arboretum turfgrass variety demonstration center would be a very worthwhile undertaking. Under the direction of Dr. Martin and Mr. Morgan and through the cooperative efforts of the Arboretum staff and the turfgrass industry, the present turfgrass center was established and to this day has continued to grow in effectiveness and importance.

The most popular facet of our Arboretum turfgrass program is the demonstration plots. Here twenty different varieties of grass and Dichondra are maintained in sub-plots at two mowing heights and two fertilizer rates. Thus we have the benefit of four treatments in each plot, namely, high cut - high fertilizer, low cut - high fertilizer, high cut - low fertilizer, and low cut - low fertilizer. The low fertilizer dates were temporarily discontinued during the summer of 1963 to insure the survival of the grasses, but are being resumed now for the advent of cooler weather.

The main scheme of these plots divides them into two sections, namely, warm season grasses and those that are at their best during the cool season. Among the warm season grasses are four hybrid bermudas, two zoysias and three bentgrasses. Dichondra is also included here. St. Augustine grass is planted in a long strip nearby. Among the cool

season grasses are four bluegrasses, one mixture containing bluegrasses, two fescues, Pensacola Bahiagrass and a mixture of Alta fescue & Bahia. An innovation included with these grasses is Birdsfoot Trefoil (*Lotus tenuis* L), an evergreen leguminous groundcover that reportedly thrives in poor soil.

The warm season grasses have seemed to profit by low cut and high fertilizer rates, being mowed twice weekly at five-eighths of an inch and bi-weekly applications of sulphate of ammonia at the rate of one-half pound of actual nitrogen per square feet. The few broadleaf weeds that appeared this year were controlled mainly by hand pulling after one treatment with 2, 4-D. Generally a dense turf resulted that seemed to resist both broadleaf weed and crab grass.

Thatch build-up was an undesirable factor with the high cut bermudas and bents but did not occur with the zoysias. Two light vertical mowings ("verticutting") resulted in increased growth after only temporary unsightliness. The mowing severed the surface runners and combed out some of the accumulation of thatch. Low cut bermudas were particularly improved by verticutting and further showed a desirable trait of not "scalping" easily during routine mowings. This was less true with the high cut bermudas and bents. The zoysias were not vertical mowed and both low and high cuts were equally satisfactory.



Kentucky bluegrass (*Poa pratensis*) and three of its selected strains at the end of a hot summer show varying degrees of survival. Newport (foreground) has a light green section, the result of re-sodding. Adjacent Park bluegrass is chlorotic. Merion is making good recovery from an all summer attack of rust and has regained most of its normal color. Kentucky bluegrass (top) is practically a complete loss after suffering from the heat and a late spring treatment of 2, 4-D for weed control. Hybrid bermudas (*Cynodon dactylon*) are at top right.

The zoysias were scalped to the ground in April and at summer's end had formed a most satisfactory turf cover except for a few spots in *Z. matrella*. Most admirable was the bright green color that extended deeply through the zoysia turf, in contrast to the shallow green tips of the hybrid bermudas over a brown thatch underlay.

An additional undesirable characteristic of the bermudas was the tendency of the leaf tips to assume a brownish cast, believed to be caused by smog. However, mowing and removing these clippings left behind a most beautiful shade of green. Cores of soil taken in the bermuda plots showed feeding roots as deep as eighteen inches. This may account for the less rigid demand for frequent irrigation in contrast to the bents which required almost daily watering.

The plots remained generally free of insects and diseases even without preventive sprays, except for Kentucky bluegrass. Weakened at the beginning of summer by an application of 2, 4-D, the Kentucky blue grass gradually declined to a point beyond recovery and the plot is now scheduled to be replanted. Rust appeared on the Merion and Newport bluegrasses but new growth was stimulated by frequent applications of nitrogen and rigorous attention to syringing with water during the heat of the day.

This latter practice gives rise to an interesting speculation. If wilting occurs the stomates close and photosynthesis ceases. Thus the production of elaborated materials within the grass leaves stops. Respiration continues at a high rate commensurate with the temperature and this results in a more or less rapid debilitation of the grasses. Frequent syringing increases the humidity about the turf and tends to prevent wilting and to encourage photosynthesis. Thus with a larger supply of elaborated food materials, these cool season grasses are better able to withstand the hot weather and to utilize a larger supply of nitrogen from the soil in its metabolism. The subsequent growth tends to stay ahead of rust infections. If subsequent experiments substantiate this theory, the role of bluegrasses as an all-year green turf may be advanced in warm climates such as we have here in Southern California.

One of the most interesting phases of the turfgrass work here is the study of completely automatic irrigation controls. We have two installations at work in the turf plots and a third one is planned. The basis for these systems is a moisture sensor buried in the soil at root zone levels which determines the actual need for water according to a present moisture percentage. When evaporation and transpiration reduce the moisture below this percentage, this information is registered at a control panel which in turn operates remote controlled valves at a preset time. The sensors are then responsible for shutting down the system when sufficient water has been applied. Thus an optimum level of moisture may be maintained automatically in the root zone of the turf, with a minimum of water waste. Timing this operation under clock control allows irrigation during periods of high water pressure at the mains and during night or early morning hours when there is little loss due to evaporation or wind blown spray. Being completely automatic, the system will function unattended as during a vacation. Aside from a reduction in the amount of water used, a higher quality of turf may be produced because of a more favorable water relationship.

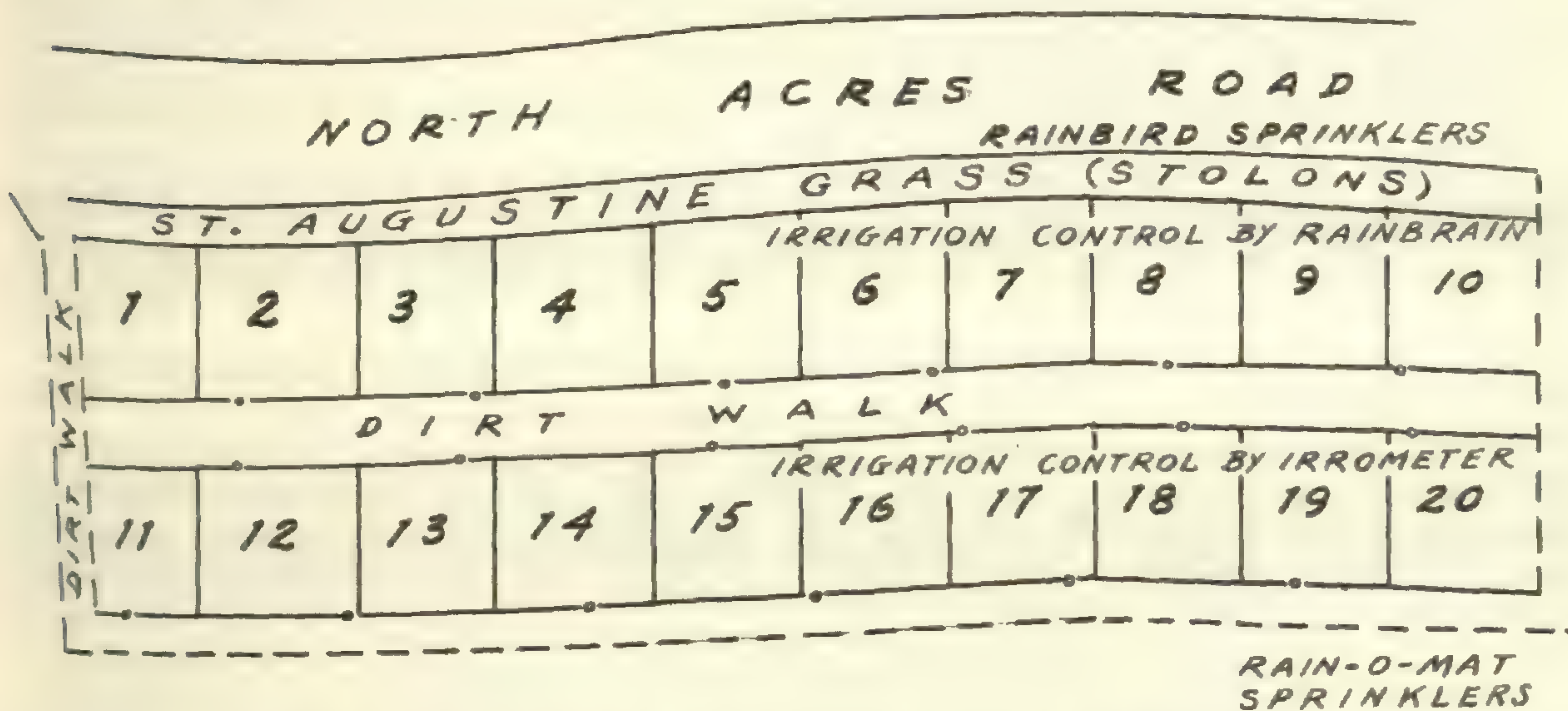
However, the garden hose is not ready to be relegated to the basement as a result of automation. Dry areas will invariably appear and should have separate irrigation as needed. Also, as previously mentioned, occasional syringing during hot and drying periods of the day appear beneficial, especially with the more shallow rooted grasses.

TURFGRASS VARIETY PLOTS

These plots show the effects that different rates of fertilization have on the various turfgrass species and varieties with different cutting heights. Each cutting height has two fertilization rates, the equivalent of three pounds vs. nine pounds of actual nitrogen per one thousand square feet for cool season grasses (left of center walk), and three pounds vs. twelve pounds of actual nitrogen per one thousand square feet for warm season grasses (on the right).

Irrigation is regulated by two completely automatic timing systems, a pre-determined level of moisture being maintained under the control of an electronic (RainBrain) and a hydraulic (Irrometer) moisture sensor, respectively, buried in the soil.

Material and equipment for the plots were donated by twenty-five or more companies specializing in irrigation equipment, agricultural chemicals and fertilizers, turfgrass seed and sod, and clay products.



KEY TO TURFGRASS SPECIES AND VARIETIES

NO.	SCIENTIFIC NAME	COMMON NAME	HOW PLANTED
1	<i>Festuca elatior arundinacea</i>	Alta Fescue	Seed
2	<i>Festuca elatior</i>	Meadow Fescue	Seed
3	<i>Paspalum notatum</i>	Pensacola Bahiagrass	Seed
4		Exposition Park Mix	Seed
5		Mixture of #2 & #3	Seed
6	<i>Lotus tenuis</i>	Birdsfoot Trefoil	Seed
7	<i>Poa pratensis</i> var.†	Newport Bluegrass	Seed
8	<i>Poa pratensis</i> var.†	Park Bluegrass	Seed
9	<i>Poa pratensis</i> (B-27)	Merion Bluegrass	Seed
10	<i>Poa pratensis</i>	Kentucky Bluegrass	Seed
11	<i>Dichondra repens</i> *	Dichondra	Sod
12	<i>Agrostis palustris</i> var.†	Old Orchard Bent	Stolons
12	<i>Agrostis palustris</i> var.†	Congressional Bent	Stolons
14	<i>Agrostis palustris</i> var.†	Seaside Bent	Seed
15	<i>Zoysia japonica</i> X <i>tenuifolia</i>	Emerald Zoysia (hybrid)	Plugs
16	<i>Zoysia matrella</i>	Manilagrass	Plugs
17	<i>Cynodon transvaelensis</i> X	T-35A Tifway (hybrid)	Sod
18	<i>Cynodon dactylon</i> sel.	Everglades-3 Ormond	Sod
19	<i>Cynodon dactylon</i> X <i>transvaelensis</i>	Magemisii - Sunturf	Sod
20	<i>Cynodon</i> sp.	Tifton 57 - Tifgreen	Sod
	*Not a grass		
	†Cultivar		

Results of this turfgrass work indicate that the ubiquitous Devilgrass or common bermuda may also be not ready for retirement. Its vigorous and hardy characteristics make it a front contender in turfgrass culture. Since so many grasses are classified as high cost maintenance turfs, economics may dictate that common bermuda remain a front contender in our recommendations. Management problems are few and the results very rewarding. New chemicals are available to keep the turf under control, insects and diseases are few, and a simple annual overseeding with inexpensive seed assures a year-round green.

Hundreds of new chemicals are being made available for the control of lawn pests, including insects, diseases and weeds. Many of these show great promise, particularly as broad spectrum pest controls or as selective herbicides. Some of these are currently being tested as a part of our turfgrass research program.

Plans are underway for an expansion of the turfgrass variety area. Immediately concerned will be the inclusion of shade tolerant grasses. Also to be added will be many varieties not now being used in Southern California.

It has been proposed that the role of Turfgrass Center for Southern California be assumed at the Arboretum. Facilities to allow exposition of permanent displays and exhibits in addition to the research and demonstration turf areas would be developed. With the cooperation of the turfgrass industry, it is expected that in the near future this expectation will be fulfilled.

There have been as many as 20 research projects in the fields of soils, pests, genetics, etc., of turfgrass at UCLA (University of California at Los Angeles). (1) At Davis (University of California), at least 17 other projects in the fields of irrigation, ecology, and nutrition are underway. More than 30 cooperative turfgrass plots are being maintained under the supervision of county farm advisors at schools and other locations and are being used for teaching as well as testing. Cal-Poly (California Polytechnic Institute) and other state institutions also have projects and courses. However, the turfgrass center here at the Arboretum is uniquely different from any of these in that a more direct relationship exists between the average home gardener and the Arboretum. The universities are mainly concerned with their students whereas the Arboretum caters to the general public. Thus it would seem that our primary role here is the dissemination of information on a caliber and level that readily meets the needs and understanding of the home gardener.

It might be added that the pending removal of the Department of Ornamental Horticulture from the campus of UCLA will deprive the local area of this important demonstration center. In view of our position here, it would seem expedient that the Arboretum coordinate and utilize all available facilities to meet the growing need for turfgrass information. We have a rapidly expanding library and expertly staffed departments of plant physiology, pathology, entomology and taxonomy which constitute a complete educational and research center.

These facilities are currently being utilized in a commendable educational program which includes in addition to youth projects, classes in home horticulture, home landscaping, plant identification, and the breeding of better ornamentals. These partially constitute the training of students in professional gardening. Also offered here is a special course in turfgrass management through the cooperation of the Extension Service of the University of California.

The Arboretum is constantly in demand as a meeting place for seminars and institutes held for the benefit of professional gardeners. Among the most notable is the annual

Southern California Turfgrass Institute, sponsored by the University of California Agricultural Extension Service and the Southern California Turfgrass Association and Council. In turn, the staff members here hold membership in all the professional associations devoted to turfgrass work and are in attendance at all seminars, institutes and meetings. Thus there is maintained a mutual interchange of scientific and practical information with these agencies.

Not to be overlooked is the relationship of commercial enterprise with our turfgrass work. Much equipment and materials have been donated for testing and demonstration as well as information on how well these provide assistance in solving turfgrass cultural problems. Knowledge of these useful tools and materials becomes imperative in a well-planned operation where the public stands to profit through their use in the establishment and maintenance of a successful lawn.

With this in mind, the Arboretum under the direction of Mr. Norman A. Isbell, Jr., sponsored a Homeowners Lawn Field Day during the spring of this year. It was a highly successful and informative event which enlisted the cooperation of manufacturers of home lawn equipment and materials. The thousands of visitors who attended during this two-day event were afforded a rare opportunity to study and compare the products of many competitive manufacturers and to select new and useful tools and supplies from a score or more of exhibits. Plans are underway for an annual repetition of this type of show as well as a supplementary one in the fall devoted to teaching demonstrations on lawn care.

Another event which enlisted the cooperation of industry was a two month long display of completely automatic irrigation controls arranged in the exhibit cases at the Administration Building. Following the appearance of related articles in POPULAR SCIENCE and POPULAR MECHANICS, equipment was assembled from over fifteen companies. Several of these had previously donated equipment for the turfplots and the goodwill created by the exhibit assured that others would also contribute.

These and other Arboretum events have been enthusiastically reported by the press, radio and television. Through these avenues of publicity we stand to derive a mutual benefit since they are able to reach the masses of people and acquaint them with our programs. Certainly, the more of the public that we contact the more our work is justified and the more we execute our duty as a public institution.

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BOOK REVIEW

LEONID ENARI

Woody Flora of Taiwan. By Hui-Lin. 974 pp. 371 illustrations. Published jointly by The Morris Arboretum, Philadelphia, Pennsylvania and The Livingston Publishing Company, Narberth, Pennsylvania. 1963. \$18.75.

The objective of this work is to present a flora of the woody plants indigenous to Taiwan, formerly known as Formosa.

According to the author the total number of ligneous species in the Taiwan flora, exclusive of uncertain ones, amounts to about 1030 species belonging to 106 families with 411 genera. Genera with 10 or more species are *Rubus* (*Rosaceae*, 31 species), *Ficus* (*Moraceae*, 26), *Symplocos* (*Symplocaceae*, 25), *Ilex* (*Aquifoliaceae*, 24), *Rhododendron* (*Ericaceae*, 19), *Smilax* (*Liliaceae*, 14), *Ardisia* (*Myrsinaceae*, 12), *Pasania* (*Fagaceae*, 12), *Eurya* (*Theaceae*, 11) and *Rosa* (*Rosaceae*, 10). While the majority of these elements are distinctly of tropical nature, a few, such as the *Ericaceae* and *Rosaceae*, are primarily temperate. This mixed nature shows the varied content of the Taiwan flora. Only three genera of woody plants are endemic to Taiwan, namely *Formosia* (*Apocynaceae*), *Micheliopsis* (*Magnoliaceae*) and *Sinopanax* (*Araliaceae*). All three are monotypic.

This work is a scholarly flora complete with keys, descriptions and distribution data. In addition, the chapters "The Physical Background of Taiwan" (pp. 3-8) and "The Vegetation and Floristic Composition" (pp. 9-20) are interesting not only for a systematic botanist, but also to anyone interested in the background of the Taiwan flora. It is not a compilation based on the literature but the result of critical revisional studies of nearly all families based on extensive series of herbarium collections with special attention paid to classical and type material. This makes it particularly trustworthy and valuable.

A few errors and contradictions were noticed here and there. For example it appears that the leaf in the illustration of *Pyrus kawakamii* on p. 291 is hairy, including the petiole, but according to the author's own description, the leaves of this species are glabrous. It also appears that at least some of the leaves in the *Raphiolepis integerrima* illustration on p. 29 are serrate, but according to the author's description they are supposed to be entire. The leaf in the *Juglans cathayensis* illustration on p. 77 shows an even number of leaflets, but according to the description they are odd-pinnate, which, of course, they are. Also, the leaves of *Xylosma congesta* (p. 611) are ovate, not rhomboid. The statement "Flowers 1-1.5 across" on p. 337 should probably read "Inflorescences 1-1.5 cm across". Such errors do not affect the quality of the book as a whole.

There are few works published on the interesting and rich flora of Taiwan. Perhaps the most recent were Kanehira's "Formosan Trees" and Masamune's "Short Flora of Formosa", both published in 1936.

Hui-Li's work can be counted as a valuable contribution to the understanding of the flora of the island of Taiwan, and the author himself is to be congratulated for his work. The reviewer is hoping, that some day in a not too distant future he has a chance to read another book from the same author covering the remaining two-thirds of the Taiwan flowering plants which are the nonligenous plants.

L. E.

Growing Notes

By GEORGE H. SPALDING

Cassia glauca which the Arboretum has recently made available to nurserymen is a new introduction. This beautiful yellow-flowered shrub from the tropical areas of Asia and Polynesia is one of the showiest plants in the Arboretum's collections. It has the typical leguminous pinnately compound foliage and masses of brilliant yellow flowers borne on a shrub six to eight feet tall, and is in bloom practically the year around. An added virtue is the ease with which it grows from seed, usually flowering when two or three years old.



Cassia glauca

Full sun and a well drained soil are the chief requirements for success in growing *C. glauca*. At the Arboretum where we have planted several in different locations those where the soil was not too rich have been the heaviest bloomers. The plants will freeze back in years of very heavy frost but usually will recover very quickly without any permanent injury or kill. It

is best to wait until the plants have begun to sprout in the spring and then prune off the dead wood only. Experience has shown that heavy pruning should not be used on this plant. Seed should be soaked in sulphuric acid for twenty (20) minutes followed by a twenty-four (24) hour period in clear water.

Seed was made available to the nurserymen in August of this year and it should take about a year for the plants to appear in the nursery trade.

* * * * *

A REFRESHING CHANGE

If you have really tried and still have had no inspiration for a lovely Christmas card really worthy of the friends you cherish, the California Arboretum Foundation is glad to be able to recommend this special collection of twelve plants and shrubs painted for us at the Arboretum where they are growing. The artist is Mr. Henry R. Mockel of Twentynine Palms, and we are so pleased with his work that we are offering for sale these folders which may be printed to order and personalized according to your wishes. Envelopes are included.

The cover of this issue of *Lasca Leaves* carries a sample of these cards, and you may look forward to seeing other examples on future issues.

You may also wish to read the enclosed list of other items for sale by the Foundation, and chances are you will find more than one welcome suggestion for Christmas gifts! Of course you have already thought of a membership in the California Arboretum Foundation for that very special gift.

Theodore Payne

By BEULA EDMISTON

Reprinted from *The Nature Conservancy News* Vol. 13 (Summer 1963) p. 14

"I was born at Manor Farm, Church Brampton, Northamptonshire, England, June 19, 1873, being fifth in a family of six boys. My father died when I was less than three years old, so I do not remember much about him, but he and my mother had planned and planted a very beautiful garden." Thus opens a brief autobiography by Theodore Payne, the slight Quaker lad who made the splendor of the California natural landscape known around the world.



THEODORE PAYNE

In his generous lifespan, Theodore Payne made a vast contribution toward the preservation and appreciation of natural beauty. Like John Muir, he saw God in all creation and felt a great kinship with all life. His genius, skill, and dogged perseverance enabled him to unlock the secrets of some of the disappearing California flora and save the species through careful propagation. He brought over 430 California native plants into cultivation and rendered them available for civic, highway and home planting. Through Theodore Payne, the use of drought resistant native plants, has literally caused the desert to bloom, and saved great sums of money in highway plantings. His zeal and quiet eloquence spread the fame of California's wildflowers around the world and placed their names and his in the horticultural literature of every continent, and California wildflowers in botanic gardens in every land. Still more significant, his infinite kindness and

gentle concern for nature's creatures and the natural scene, were contagious. Theodore Payne made a difference in people. The slogan under which he operated a successful native plant nursery in Los Angeles for almost 60 years was: ENJOY — DO NOT DESTROY. Few people can express a philosophy so briefly or live it so completely.

To this gentle and unassuming man who claimed only to being a horticulturalist, came recognition both at home and abroad. Medals, scrolls, plaques, cups, citations, and resolution came from near and far. The California Federated Garden Clubs were naming him "Man of the Year" at the time of his death. The honor was awarded posthumously. The Nature Conservancy was one of 33 organizations to pay him honor when the Los Angeles County Board of Supervisors hosted the celebration of Theodore Payne's 90th birthday on the regular agenda of their meeting.

The roster of organizations of which he was a Life Member is revealing: Southern California Academy of Sciences, Southern California Horticultural Institute, Wilderness Society, Audubon Society, Save the Redwoods League, Fellow, Royal Horticultural Society of England; Committee for the Preservation of the Tule Elk, and The Nature Conservancy. Theodore Payne was one of The Nature Conservancy's most ardent supporters of principles and projects. For many years, Mr. Payne was a prolific writer for scientific journals. His delightful book, "Life on the Modjeska Ranch in the Gay Nineties" was published only last year.

Dedicated admirers determined that the work of Theodore Payne must not end, so that THEODORE PAYNE FOUNDATION FOR WILDFLOWERS AND NATIVE PLANTS was incorporated; Theodore Payne its Founder and Honorary President. Only months before his death on May 6, 1963, permanent home for the Theodore Payne Foundation was dedicated in the Whittier Narrows, in the metropolitan area of Los Angeles (and adjacent to the Audubon Center with which he was so closely associated) in cooperation with the U. S. Army Corps of Army Engineers and the County Board of Supervisors.

Mr. Payne is survived by his beloved wife, Alice Noyes Payne, and a host of friends, who, because of him, are dedicated to the preservation of natural areas as LIVING MUSEUMS of primeval America.

News of a Bill, H.R. 6407 (Burkhalter), to establish a National Wildflower Sanctuary in California was brought to Theodore Payne on his deathbed. His face lit with joy. "This is a dream come true. I've worked and fought for the preservation of our natural landscape most of my life. This must be accomplished before California's glorious poppy fields are forever destroyed." He paid tribute to the Los Angeles County Wildflower and Wildlife Sanctuaries which inspired the National Sanctuary Garden Clubs and The Nature Conservancy and devoted individuals. History will record the fact that an article by Theodore Payne in the California Federated Garden Clubs *GOLDEN GARDENS* entitled, "The Urgent Need of Wild Flower Preserves" sparked the entire movement to ENJOY — NOT DESTROY one of the last great California poppy fields.

Growing Cymbidiums in a Shade Garden

ERNEST HETHERINGTON

Vice-President and General Manager Fred A. Stewart, Inc.

(Continued from Summer issue)

Light is perhaps the most important factor in the successful flowering of cymbidiums. A good general rule is: give plants sufficient light, so that the foliage is greenish-yellow, rather than verdant green. A good rule-of-thumb is—give what you may think is too much sun, rather than too little. If growing under trees, place the plants near the drip line rather than near the trunk of the tree. Measuring light in foot candles, the meter should indicate 2,000 to 4,000 during the growing season. Though lath, sheet plastic or other materials are good for shading, woven plastic screening called Saran is most often used in southern California and many other parts of the country. In areas of cold winters, cymbidiums are frequently summered out-of-doors in light shade. Insufficient light is more responsible for cymbidiums not blooming than any other cause. However, you must shade heavily when the plants are in bloom, as the flowers will last longer and you will get clearer colors. When plants have finished blooming, take off most of the shading.



The cymbidium cross Lillian Stewart has received more awards throughout the world than any other orchid in the history of orchid breeding.

Cymbidiums need lots of water. During the active growing season (roughly March-September in most areas), plants should be watered sufficiently to keep compost on the moist side, in fact, wet compared to cattleya culture. One of the main causes of leaf-tip die-back is insufficient water during the growing season. Cymbidiums must have good drainage at all times. Wooden tubs are preferable as they do not dry out as rapidly as clay pots. Overhead sprinklers may be used for watering during the summer if plants are well-soaked. On sunshiny summer days plants benefit from spraying of the foliage, thus keeping temperatures down through evaporation and increased humidity. During winter months, when growth is at a minimum, the plants can be run drier, but never bone-dry. Sufficient water to avoid shriveling of bulbs is a good general rule during cold winter months.

Feeding is always important with orchids and especially so with cymbidiums. Your plants will greatly benefit from a regular feeding program even if your potting mix contains enough nutrients to provide a reasonable food supply.

From January through July a high-nitrogen water soluble (3-1-1) fertilizer is recommended. This can be used at the rate of one or two teaspoons to the gallon of water every ten days to two weeks. You will not need to feed on overcast winter days because the plants cannot use the food. A low-nitrogen fertilizer (6-30-30) at the same concentration and frequency is used from August through December. Be sure to drench the pot well if using a water soluble fertilizer which dissolves readily. Various dispensers are available for this care.

Cymbidiums are quite tolerant of a wide range of temperatures. When grown outside in southern California, they will stand normal summer temperatures in the 80°s and 90°s. Be sure there is free circulation of air. During the summer, cymbidiums benefit from a good leaf syringing several times a day, if possible. Under these growing conditions, they will stand down to freezing (32°F.) with relatively no harm. They will even withstand several degrees of frost; however, flower spikes are apt to be injured by these low temperatures. Even in southern California, it is best to have some sort of a winter shelter if only to keep excessive winter rains off the plants.

When growing in a greenhouse, more optimum temperatures may be maintained. Summer greenhouse temperatures may go into the 80°s and 90°s, with no harm. Night cooling in late summer is important. When plants are showing spike or are in bloom, try to maintain a minimum temperature range at night from 45°F. to 55°F., and not over 60°F. If the temperature goes over this at night, you are risking bud drop. Unflowered seedlings and non-flowering propagations can be grown warm the year around until flowering size is attained.

In the hot arid parts of the country, the evaporative cooler, or so-called desert coolers, are a great aid in maintaining humidity and keeping down excessively high day temperatures, if plants are grown in a greenhouse. They work on the principle that if hot, dry air is passed through water (wet pads), it loses its temperature and picks up moisture. This is why coolers of this type work so well in the arid southwest. The cooler is installed outside the house and air is blown in through a duct under the benches. Often temperatures as much as 10° to 20° below the maximum outside can be maintained, if weather is hot and if the outside humidity is low.

(To be concluded in next issue.)

The Bracken Fern

BARBARA JOE

Bracken is perhaps the commonest fern in the world, and is especially plentiful in California from our sagebrush to forest land where sufficient moisture exists for its growth. Its bundance permitted settlers to use it for thatching roofs. Indians made tough ropes, textiles, and baskets from the rhizomes which were also valued as food for the high starch content. During the late 1600's Europeans were so destitute of wheat that bread was made from the rhizomes of this fern. In Siberia the rhizomes were mixed with malt to brew a certain kind of beer. Today young fiddleheads are still gathered as food by people in many parts of the world. The toxicity of bracken to livestock is well known and is partly explained by the presence of an enzyme, thiaminase. As the name indicates, the enzyme destroys thiamin, vitamin B₁. Horses severely afflicted with this nutritional deficiency were reportedly cured by injections of thiamin. Indications are that bracken may be rendered harmless to livestock by heating.

Some California Indians reportedly ate the young fronds raw. This may mean that man, at least the Miwok Indians, is not affected by the toxin or that young fiddleheads do not accumulate the toxin. Nevertheless most cultures prepare their dishes by cooking the fiddleheads. Among the Japanese, tender fiddleheads are boiled and served in soups or seasoned with sugar, soy sauce, and sesame seeds. Sometimes the latter ingredients are ground together to form a thick paste which is served as a side dish. The flavor of the fern itself is difficult to distinguish from the seasonings. It is generally described as tasting somewhat like bland asparagus. Western culture has devised several recipes of interest including one for creamed bracken.

Aside from its culinary interest, bracken is used as a garden ornamental. This may be deplored by those who have had to eradicate this fern as a troublesome weed. On the other hand some gardeners choose to have bracken rather than a variety of weeds. Perhaps the most common use of bracken is that of fillings in borders or neglected places where weeds would tend to grow. Areas between large shrubs are sometimes planted with bracken. The result is a mass display of pleasing textural contrast reminiscent of our forest areas. Smaller plants would most likely be crowded out by the bracken as it spreads by means of underground rhizomes. Plants usually reach 1 to 4 feet in height under cultivation, but are known to reach 9 feet in the wild.

The scientific name of bracken is *Pteridium aquilinum*. The genus *Pteridium* is generally considered to contain but this one variable species. The botanical description is:

Pteridium aquilinum (L.) Kuhn, (*Pteris aquilinum* L.). Bracken or brake. Medium to large terrestrial ferns; rhizomes long creeping, branched, underground, hairy, slender; frond arising one at a time, 3 to 4 times pinnate, triangular to elongate, densely hairy, the texture firm to leathery, the veins free except for an inconspicuous marginal strand connecting the vein ends; sori linear, borne along the margin, frequently continuous around the tips of segments and sinuses; indusium obscure, being covered by a conspicuous false indusium, the reflexed leaf margin. (Fig. 2) Tropical and temperate areas of the world.

var. *pubescens* Underw. (var. *lanuginosum* (Bong.) Fernald). Western bracken. Growing tip of rhizome with tuft of dark hairs, the leaf surfaces between margin

and midrib of segment hairy, the indusium ciliated. California to Alaska, scattered areas to Quebec.

var. *latiusculum* (Desv.) Underw. Eastern bracken. Growing tip of rhizome with whitish tuft of hairs, the leaf surfaces between margin and midrib of segment essentially glabrous, the indusium glabrous. Eastern Canada, Northeastern United States and scattered areas west.

var. *pseudocaudatum* (Clute) Heller. Growing tip of rhizome with tuft of dark hairs, the leaf surfaces between the margin and midrib of the segment essentially glabrous, the indusium glabrous. Eastern United States to Oklahoma and Texas.

Pteridium is difficult to transplant, being best done in spring with young plants. A robust rapid grower, it is considered a weed in some areas. A hardy evergreen at temperatures above 40°. It is otherwise deciduous and grows to 9 feet tall. It can be grown in sun or shade and light watering is needed.

Pteridium is distinguished from other bracken-like ferns by its linear sori. It may be possibly confused with the Australian brake, *Pteris tremula*, and *Histiopteris*, both differing from *Pteridium* by the absence of hairs throughout the plant.



Typical Indusium

BRANCHING PALM

Ordinarily palm trees do not branch. This unusual photo made by Ralph Cornell shows a specimen of *Washingtonia filifera* located in Oakland, California. It is a case of the exception proves the rule!





Speculation suggests that the branching shown in this close-up may have resulted from an injury of a mechanical nature to the trunk.

L A S C A L E A V E S

WEATHER RECORD — 1962

Los Angeles State and County Arboretum, Arcadia, California

LATITUDE 34 deg. 8 min. 48 sec. N.

LONGITUDE 118 deg. 2 min. 59 sec. W.

TEMPERATURE

MONTH	PEAKS		AVERAGE		RAINFALL INCHES
	MAX.	MIN.	MAX.	MIN.	
January	88	31	68.4	40.9	3.99
February	81	30	59.5	43.1	*14.47
March	84	32	63.9	*40.3	1.56
April	97	44	78.5	49.5	.02
May	92	42	73.6	49.6	.78
June	96	48	79.7	54.0	.01
July	96	51	87.8	56.8	.00
August	*101	54	*93.0	61.0	.00
September	100	50	87.8	56.4	.00
October	98	46	87.7	52.1	.13
November	92	37	72.7	46.6	.00
December	83	*29	68.5	41.5	.04
					TOTAL 21.00

WEATHER OBSERVATIONS

TEMPERATURE

HIGHEST 101 on August 16

LOWEST 29 on December 27

NUMBER OF DAYS WITH—

Max. 90 deg. or above 69

Min. 32 deg. or below 9

Max. 100 deg. or above 5

Min. 40 deg. or below 60

PROLONGED HEAT 16 Days Aug. 6 - Aug. 21 (92°-101°)

COLD 7 days Dec. 35. - Dec. 31 (38°- 29°)

RAIN — recorded on 40 days TOTAL — 21 inches

LONGEST STORM 6 days Feb. 7 - 12th—10.33 In.

HIGHEST 24 hrs. Jan. 20th = 2.51 In.

DAN MARTEL Plant Recorder & Weather Observer

University of California, Los Angeles, Subtropical Horticulture Area

LATITUDE 34 deg. 8 min. 48 sec. N.

LONGITUDE 118 deg. 2 min. 59 sec. W.

TEMPERATURE

MONTH	PEAKS		AVERAGE		RAINFALL INCHES
	MAX.	MIN.	MAX.	MIN.	
January	86	36	67.6	42.5	3.25
February	77	32	59.3	42.2	15.83
March	75	33	61.8	41.3	1.29
April	94	43	72.4	48.4	0.00
May	85	43	68.3	48.6	0.05
June	83	48	70.2	52.6	0.00
July	80	50	73.5	55.1	0.00
August	88	52	79.1	57.2	0.00
September	90	51	75.7	56.2	0.32
October	94	48	72.0	53.4	0.03
November	78	41	67.5	48.0	0.01
December	79	33	64.5	43.8	
					TOTAL 20.78

Prepared by LYLE PYEATT



H. R. MOCKEL



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After long effort in locating the artist, working out the technical problems of the production and planning the sale of these cards, we are proud to present such a series. We believe these designs to be of excellent quality and certainly appropriate. Mr. Henry Mockel, the artist, executed the drawings at the Arboretum directly from the subjects.

The enclosed sample card, illustrations of the entire design group, and an order blank for your convenience in ordering, may be removed without damage to your Lasca Leaves. I urge you to order promptly, particularly personalized Christmas cards and the 1964 calendar, to provide ample time to receive them for mailing before the Christmas dead-line.

I am convinced you will send these cards to your friends and associates with pride and with pleasure in knowing your purchase will aid the Foundation in the continued support of the Arboretum.

Sincerely,

CALIFORNIA ARBORETUM FOUNDATION, INC.

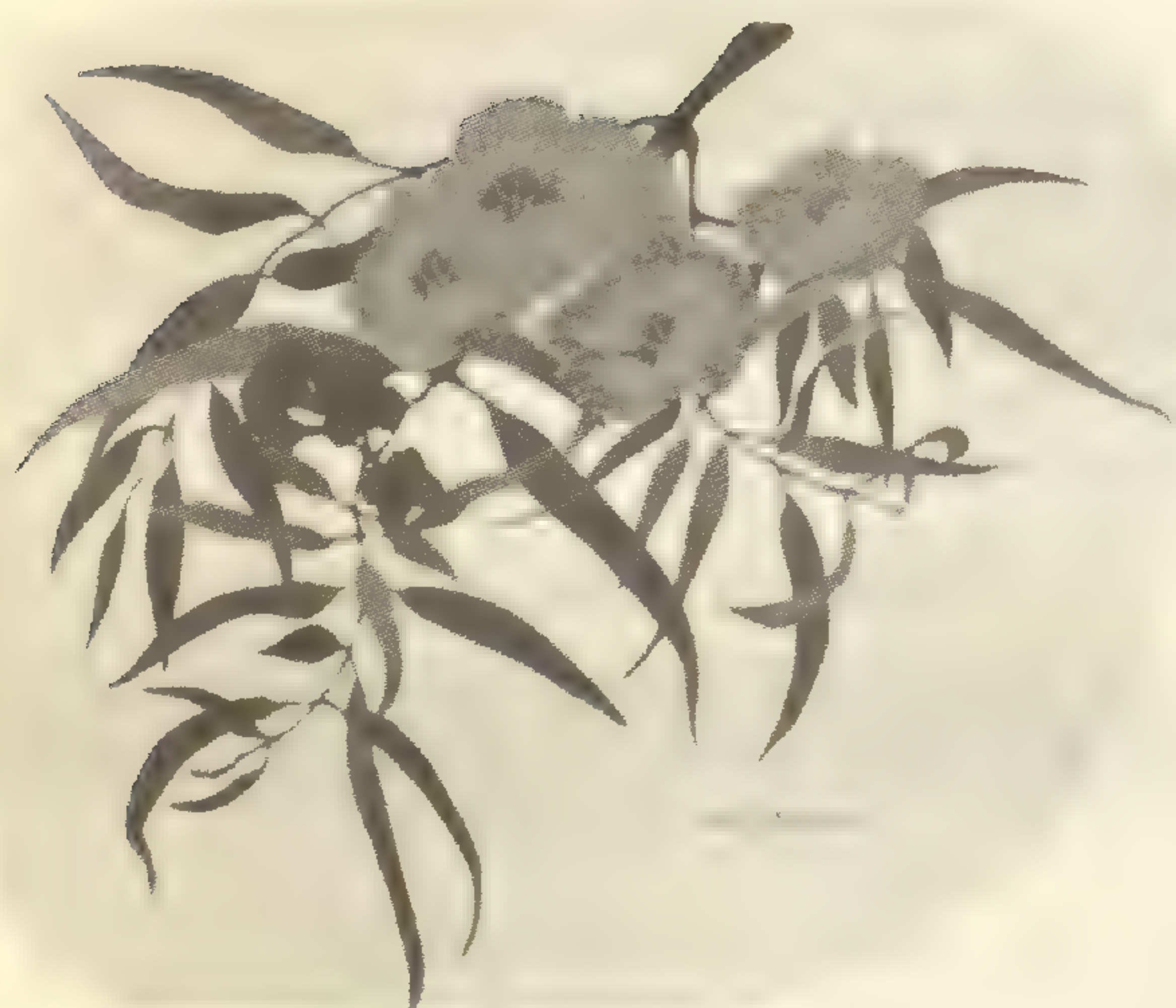
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101 Fire Wheel Tree



103 Floss Silk Tree



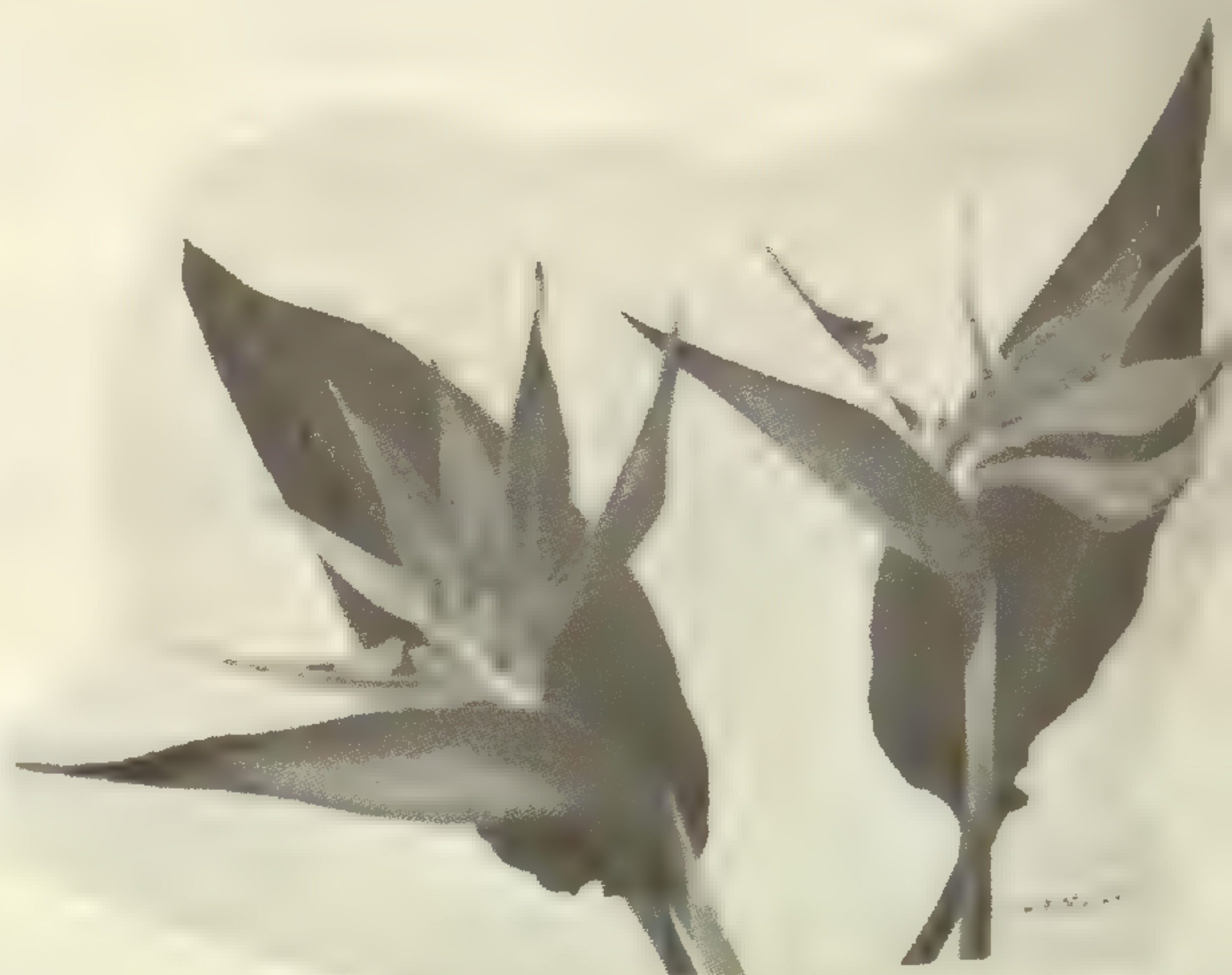
112 Red-Cap Gum



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Index Vol. XIII, 1963

LASCA LEAVES INDEX VOL. XIII, 1963

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COVER PICTURE

This spectacular photo of LASCA LAGOON was made by Mr. Ralph Cornell. We reprint it through the courtesy of Locale Magazine. It was printed for us as a demonstration of color reproduction by the A. B. Dick Company.

CALENDAR OF EVENTS

JANUARY

- Saturday, January 18 Arboretum Historical Tour for Members and Guests 9:30
- Friday, January 24 "Plant Collecting in New Guinea"
Lecture by Dr. George Kennedy of UCLA
8:00 P.M. Lecture Hall
- Friday, January 24 and
Saturday, January 25 Western Division National
Shade Tree Conference

FEBRUARY

- Tuesday, February 11 C.A.F. Day at the Races
Santa Anita Race Track 11:30 A.M.
- Saturday, February 22 and
Sunday, February 23 Arboretum-Temple City Society
Camellia Show 9:00 to 5:00 P.M.
- Saturday, February 29
and Sunday, March 1 Descanso Gardens Annual
Camellia Show 9:00 to 5:00 P.M.

MARCH

- Friday, March 6 "Cactus and Giant Tortoises of the Galapagos"
Lecture by Dr. Yale Dawson
8:00 P.M. Lecture Hall
- Saturday, March 14 and
Sunday, March 15 Annual Daffodil Show at
Descanso Gardens 9:00 to 5:00 P.M.

APRIL

- Monday, April 6 Arboretum Tour for Members and Guests
- Friday, April 17 "Plant Collecting Safari in Africa"
Valley Knudsen and Maurice Machris
8:00 P.M. Lecture Hall

First Sunday of each month: Bird Walk 7:00 to 9:00 A.M. Meet at Gatehouse

Note: Among the special Plant Societies meeting at the Arboretum this season are those for Orchids, Camellias, Begonias, Iris, Hemerocallis and Amaryllis.

CALIFORNIA ARBORETUM FOUNDATION NEWS

"Flowering Trees for Year-Round Color in Southern California" has just been published under the direction of our own Dr. Samuel Ayres, Jr. by the California Arboretum Foundation, Inc. in cooperation with Los Angeles Beautiful and the Southern California Horticultural Institute.

This 36-page booklet includes pictures and descriptions of flowering trees which are now growing successfully in our county. The trees are listed by seasons showing a succession of color from January through December. Complete information on proper and common names, temperature tolerance, and locations where they may be seen growing, along with 35 color plates, make this a valuable source for homeowners, landscape architects, nurserymen, park and street department personnel and civic beautification groups. It also makes an attractive gift or souvenir. It may be ordered through the Foundation Office.

Our Foundation Lecture Series opens on Friday, January 24 at 8:00 P.M. when Dr. George Kennedy, Professor of Geo-Chemistry at U.C.L.A. discusses the collecting of orchids and other plants on his trip to New Guinea last year. He is also interested in anthropology and his colored slides are especially exciting. Dr. Yale Dawson, the new Director of the San Diego Museum of Natural History, speaks to us on "Cactus and Giant Tortoises of the Galapagos" on Friday, March 6, and "Plant Collecting Safari in Africa" will feature Valley Knudsen and Maurice Machris on Friday, April 17. Phone the Foundation Office 447-8207 to make reservations.

"Day at the Races" is all set for the California Arboretum Foundation members and their guests for Tuesday February 11, beginning with a tour of the Santa Anita Turf Club Gardens at 11:30 A.M. Those who wish to may order luncheon from their tables in the terrace area reserved for our group. Mrs. Rudolph Richards, Social chairman, is planning on a large turn-out for our gayest project of the year! Don't forget to let her know how many guests you are inviting.

Your attention is called to two items on the list for sale at the Arboretum. We now have the Henry Mockel correspondence cards selling for \$1.50 for an assortment of twelve of the colorful shrubs and plants painted here at the Arboretum. The Lindenia Orchid Prints are available for \$2.50 to \$4.50 for plates 11 x 14½. They run from \$12.50 to \$30.00 framed.

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SOUTH COAST BOTANIC GARDENS FOUNDATION has plans already outlined for their Flower Show in June to be held in the new Service Building which is now being constructed.

THE DESCANSO GARDENS GUILD will sponsor the Annual Daffodil show on Saturday and Sunday, March 14 and 15, at which time the Patricia Reynolds Trophy will be awarded. This excerpt from a letter to Dr. Stewart from Father Bede Reynolds is apropos:

"Patricia Pfitzer Reynolds spent her childhood on a farm in the San Joaquin Valley where her grandparents arrived in a prairie-schooner in the eighteen-fifties having come to America from Bavaria where the variety name "Pfitzeri" is not uncommon in horticultural annals. Kenyon L. Reynolds was born in "Faculty Row" at the Michigan Agricultural College where his father was acting as Secretary of the Michigan State Board of Agriculture. When these two married in 1915, the first five years were spent in the desert oil fields at Taft, California, where water at three cents per barrel was carefully distributed to keep alive a tiny patch of soil hardly entitled to be called garden.

All this, perhaps, gives a hint as to why we were both inclined to go "all-out" for a real garden when I was transferred to Los Angeles, and for twenty-four years it became our major interest. I was inclined to be single-track in my garden interests and became what might fairly be called a "fan" atic Daffodil hybridizer. Patricia enjoyed all flowers, especially orchids.

In 1935 we spent three months in the British Isles visiting every Daffodil show and every grower of note. We came home with over one hundred new varieties and set about the fascinating business of growing and blooming new Daffodil hybrids from seed. With Stillman Berry at Redlands, Jan de Graff at Sandy, Oregon, Tom Craig at Highland Park, Joe Urmston in South Pasadena, and Mrs. Harry Bauer in Pasadena, plus many others who were becoming interested, the Daffodil Shows at Pasadena began to take on real merit.

But, as World War II was ending and our little world of happy gardening came to an end with the death of my Patricia, what could be more appropriate, as a parting boost for the garden specialties which we had loved, than to give a perpetual trophy for each, a bowl for the Daffodils and a tall vase for the Cymbidiums. The credit for the beauty of these trophies should be divided between Mrs. Harry J. Bauer, who arranged for their presentation after I had become a Monk, and Mr. Clemens Friedel, the artist in silver, who designed them. If they are helping to promote interest in their respective fields, I am sure that nothing would be more pleasing to her in whose memory they have been given.

Of the Daffodils which we grew from seed, I selected and registered with the Royal Horticultural Society of London, fifteen named varieties. That means that about one out of every two thousand seedlings was worthy of a name. The last, and I hope not the least, was named in 1963—"Patricia Reynolds." It is my hope that arrangements will be made so that a bulb of this little trumpet variety with a pale apricot cup can be given to every future winner of the Daffodil Trophy."

Search for Orchids

A New *Mormodes* from the Sarapiquí District of Costa Rica

J. A. FOWLIE, M.D., *Research Associate UCLA*

New species sometimes turn up in the strangest places and the present example is no exception. For some years now the Los Angeles Arboretum has been developing a collection of habitat-bearing orchid plants cultured by Joe Lerchenmuller under the direction of Dr. Stewart and Glenn Hiatt. Numerous trips have been made to the tropical regions and collected plants naturalized at the Arboretum have commenced flowering out revealing some interesting information. These plants are carefully photographed, studied, and preserved and the literature and herbaria searched to reveal discovery of plants "lost" to cultivation (i.e. previously described but no longer cultivated) and "new" to cultivation (i.e. previously undescribed). Wherever possible fine botanical plates of these species have been made by Mrs. Patricia Roberts of Pasadena, an example of whose work illustrates this article.

During development of the Costa Rica collections at the Arboretum the past five years, many "lost" species have been subsequently refound and are currently in cultivation. But only rarely has a totally "new" species made an appearance . . . so comprehensively has this region been collected previously, particularly by the Germans in the mid 1800's and more recently in the early 1900's.

The plant in question came to us first in 1961 following our Costa Rica expedition for plants the prior November. It was sent the summer of 1961, having been collected by Mr. Clarence K. Horich from "Thatched Roof of Hut on N. Shore of Laguna del Cerro Congo, 12 mi. NW of Cariblanco 800M." This plant flowered the following fall when we were preparing to embark for another expedition and for the most part was ignored and labelled "*Mormodes atropurpureum*," appearing very much like a similar plant illustrated by Teuscher in *Amer. Orch. Soc. Bull.* Vol. 30 p. 650 Aug. 1961. At the time neither preserved material nor slides were made of it.

Sometime thereafter I commenced amassing the known literature on this genus and came across an illustration by Allen in *Annls. Mo. Bot. Gard.* Vol. 36 p. 355 1949 of a plant with a very different flower labelled "*Mormodes atropurpureum*" in which the margins were revolute and the labellum convex (instead of involute with a concave labellum as was Teuscher's concept of this species). Checking back with our own material I found that the plant in question was no more and had perished with flowering—leaving the problem in a muddle. The next spring a private collector, Mr. Ralph Spencer of San Marino flowered out another plant with identical flowers also obtained from Horich, but unfortunately without locality data. A look at this plant with reference to the literature now proved to me conclusively we must be dealing with two different species. Shortly thereafter Mr. Spencer and I left for another month of orchid collecting in Costa Rica and amongst other events planned was a trip to the Laguna del Cerro Congo.

The region in question lies in the newly opened Sarapiquí district of Costa Rica where a new road from San Jose has proceeded over the top of the Cordillera Central and then drops abruptly to the Atlantic Rainforests to the North. Shortly after passing through Cariblanco (830 M), a road goes off to the left 15 miles across a low tableland and then along the rim of an extinct volcanic cone. This cone is actually an ancient caldera, formed by the collapse of the central area of an extinct volcano and has sheer 500 ft. walls on all sides except to the North where it has been eroded open. In the bottom of it lies a beautiful fresh water lagoon with crystal clear emerald blue green water. The humidity and rainfall of the region is further enhanced by this geological phenomenon. At Mr. Horich's direction we proceeded downwards along a road from the top of the caldera collecting on a bank some rare plants of *Sieverskingia fimbriata*, appearing for all intents and purposes like juvenile *Stanhopeas*. Mr. Horich recognized them at once and pointed out the differences. We thence made our way to the caretakers hut* on the N. shore, from whence the original plant was collected, only to find that a few days earlier the roof had been torn apart and replaced with a bright new thatch of palm fronds. The old roof was discarded in a nearby trash pile.

After considerable moaning and complaining we brought ourselves to examine the trash pile and 15 minutes of digging through all manner of trash, refuse, bottles, barbed wire, wasps, and fire ants revealed a broken *Mormodes* pseudobulb! We kept this and a few minutes later another piece appeared. These plants were then carefully labelled, cleaned and brought back to U.S. where in the spring of 1963 both flowered providing us with the necessary material for study. The pseudobulb with the broken surface bloomed a typical type of *Mormodes buccinator* Lindley but the other plant was indeed our new species. I was still not satisfied until I had an attempt to recheck the literature and see the real *Mormodes atropurpurea* Lindley. This later opportunity was provided by Dr. Joergen Hansen of Instituto Interamericano at Turrialba who sent a slide and live plant of this species collected from the Chirripo. Now there could be no doubt we were dealing with an undescribed species, allied to but different still from Teuscher's plant. I then forwarded materials to Mr. Summerhayes of Kew Botanical Gardens who kindly confirmed for me off Lindley's Type sheet that Allen's representation of *Mormodes atropurpurea* Lindley was the correct one.

Mr. Henry Butcher of Volcan Chiriqui has kindly confirmed for me that he has never seen the new species in Panama; instead the typical *Mormodes atropurpurea* Lindley is occasionally encountered from his area. This tends to suggest the new species is limited to Northern Costa Rica and Nicaragua (where Mr. Heller has sent me specimens compatible with the diagnosis).

The new species is named in honor of the venerable Costa Rica Collector, Mr. Clarence Kl. Horich, who has so generously and unselfishly given of his time and talent to develop our investigations, and I take this method of recognizing his contribution. The diagnosis from related species together with its description follows.

*It should be mentioned that the members of the genus *Mormodes* appear to have a growing preference for dead and decomposed wood. As a net result they frequently take seed and grow in nature on rotting fenceposts, dead trees, and thatched hut roofs where the present example was collected originally by Mr. Horich.



Mormodes horichii

sp. nov.

Mormodes horichii J. A. Fowlie, M.D., Sp. Nov.

Planta—epiphytica *Pseudobulbi*—caulescentes infra medium c. 3cm. diametientibus; *Folia*—lanceolata, deciduosa in florente, c. 30 cm. longa et 4.5 cm. lata. *Racemus*—lareralis, densus, oblongus, pedunculatus, ex pseudobulbo medio, laxis 5-15 floris. *Flores*—obscuri-sanguinei, non punctati, immaculati, *Mormodes stenoglossum* Schlechter facei et aequimagni. *Sepala*—ovata-acuminata c. 3 cm. longis x 1.2 cm. latis. Sepalum superiorum supra columna cucullatum. Sepala lateralia lineariblonga aequalia, reflexa, basibus lateralium paulo obliquis et ungui labelli adnatis. *Petala*—quam sepala paulo latoribus et paulo brevioribus, glabris, c. 2.8 cm. longis x 1.5 cm. latis, ovato-acuminata, supra columna cucullata. *Labellum*—integrum, non-lobulatum, concavum, obtrullatum vel angusto obovatum c. 3 cm. longo, transverse late c. 2.5 cm. lato, leviter unguiculatum, cum marginibus lateralibus distalibus involutis. Apex labelli mucronatus, involutus supra columna cum occultatione desuper. Nervus medius crassus. *Columna*—1.7 cm. longa, torta, acuminata. *Pollinia*—4 *Ovarium*—pedicellatum, 3.4 cm. longum.

This species is at once distinguished from *Mormodes buccinator* Lindl., *Mormodes wendlandi* Rchb. f., *Mormodes colossus* Rchb. f., *Mormodes hookeri* Lem., *Mormodes powellii* Schlechter and *Mormodes skinneri* Rchb. f. by its concave labellum with involute distal margins, and concealed column with the upturned apex of the lip, rather than the convex labellum with revolute distal margins and exposed column of these species. *Mormodes lobulatum* Schl., and *Mormodes atropurpurea* Lindley are in addition three lobed as well as having these features, at least in the case of the latter species. Only *Mormodes stenoglossum* Schlechter* is very closely related sharing with this species the concave labellum and turned up margins with mucronate apex folded over and concealing the column from above. Unlike the present species, however, *Mormodes stenoglossum* Schlechter inhabits primarily the Pacific Slope of Costa Rica, has sulfur yellow immaculate flowers, and has a much narrower, longer obovate lip with a mucronate apex.

There appears to be an increased tendency in the literature to "lump" the revolute and involute sections of this genus together, as if the flower appearance was a simple variation. This is very regrettable since anyone who has collected living plants of the two can see differences in the pseudobulbs and growth habit. The species with the involute margins of the distal labellum (concave lip), the apex of which is rolled up over the column, are sufficiently distinct both geographically and structurally to deserve sectional status and ought never to have been confused.

The two distinguishing features of the flower are the distal turned up portions with involute margins folded over and concealing the column from above, and its dark blood-red color.

Locality; "Thatched Roof Hut (from a trash pile) N. Shore of La Laguna del Cerro Cerro Congo, 2500 ft., 12 mi. NW of Cariblanco, Costa Rica."

Recently through the study of materials furnished by Mr. Heller of Nicaragua, I have learned that this is the commonest species encountered there, the others being quite uncommon. Perhaps, it has just reached this portion of Costa Rica and is a primarily Nicaraguan plant. Honduras has produced typical *Mormodes buccinator* Lindley but, as yet, no other species is identifiable from there.

The type specimen is deposited in the Herbarium of University of California (UCLA) for interested students.

*Fide Schlechter *Fedde Repert. Beih.* 19 p. 225 1923; non Ames & Correll, *Orch. Guat.* p. 514 1953 which is *Mormodes nagelii* L. O. Williams.

A REPORT ON BIRD INTRODUCTIONS

GERTRUDE WOODS

On January 3, Bud Elder, Federal Fish and Wildlife Agent, released the following birds in Lasca Lagoon. He had reclaimed them from illegal possession in San Diego County.

- 4 Canadian Geese (pinioned)
- 1 Snow Goose (pinioned)
- 4 Fulvous Tree Ducks (pinioned)
- 4 Wood Ducks — 1 M., 3 F.
- 7 Baldpate Ducks — 2 M., 5 F.
- 1 Cinnamon Teal — M.
- 3 Pintail Ducks — 1 M., 2 F.
- 2 Gallinules

There seems to be a definite increase in migrants stopping here this year. Only 9 of the above could be considered "permanent" residents although the Wood Duck will likely stay. We expect to get nesting boxes for them from another interested bird man, Dr. Salter.

A BOOK REVIEW

By GEORGE SPALDING

Hui-Lin Li: *The Origin and Cultivation of Shade and Ornamental Trees*. University of Pennsylvania Press, \$6.00.

In his preface to this book the author states that it is a treatise on the historical aspects of our ornamental and shade trees, and that its purpose is to provide information about the origin, beginning of cultivation, and variation under domestication of the common species of trees that are closely associated with men in their settled habitations.

The author proceeds to do this in a very fine and interesting manner. He has brought together between the covers of this book information that has previously been scattered through many publications. The excellent bibliography will enable anyone interested in more detailed information to obtain it with a minimum of effort.

In addition to bringing together much information that has previously been published, the author has done some original research in order to prove or disprove some of the previously published material. The information Dr. Li presents on Gingko illustrates this point very well.

The limitations presented by a book of this size compel the author to make a decision as to which trees shall be included and which shall be omitted. Here again, Dr. Li has made excellent choices even though those of us who live in the warm temperate areas of the United States might wish he had included a few of the better known trees of our area such as the Olive, Pepper, and Eucalyptus.

Everyone interested in trees and their history will find much of interest in this book.

Better Hybrid Hibiscus for Southern California

ROSS H. GAST — Collaborator
Los Angeles State and County Arboretum

Set up primarily to develop cultivars better adapted to Southern California conditions than those now available, the Hibiscus* Project of the Los Angeles State and County Arboretum at Arcadia is not new, but a re-orientation of a program begun in 1946 by the writer, and conducted privately during most of the intervenient years. First seedling plantings were at the Lux unit in 1958, but due to lack of facilities for extending the work, it was decided this year to carry forward the project under glass. A research greenhouse was made available so that seedling development and observation could be accelerated.

Unfortunately, published records on any systematic hibiscus hybridization approach are extremely limited, but old horticultural journals show that some progress had been made to improve hibiscus before it was introduced into England, in 1731, by Phillip Miller. The first recorded hybrids, however, were announced by English greenhouse growers during the first decades of the last century, when hibiscus was an extremely popular "stove plant." Since that time, some interest in hibiscus hybridization has been shown in India, Australia, South Africa and other countries where this exotic flower is grown. In the continental United States, a great deal of activity in seedling development has been seen in Florida and Louisiana in recent years, which, together with our own efforts in California, resulted in the organization of the American Hibiscus Society in 1951.

But hibiscus hybridization has reached its highest development in Hawaii where hobbyists have been active for over 70 years. This interest reached its peak during the years 1910-1914, during which time the Hawaiian Agricultural Experiment Station published its Bulletin 29 (1913), *Ornamental Hibiscus in Hawaii*. This publication, although fifty years old, remains the best published information on hibiscus hybridization. While put out by an authoritative agency, it was mainly the work of a hobbyist, Valentine Holt, temporarily put on the H.A.E.S. staff to report on his many years' of work with both *r. Sinensis* and the endemic Hawaiian species.

However, the most extensive recent work with hibiscus got underway only five years ago at the National Arboretum, Washington, D. C. under Dr. Donald Egolf, cytogeneticist. Although Dr. Egolf's objective has been the improvement of *H. Syriacus* cultivars through observation and selection of material from many parts of the world, he is also approaching his objective through intervarietal crosses in his collection of hibiscus species and cultivars.

*For the purposes of this paper, the term "hibiscus" will refer to those hibiscus cultivars commonly grown in tropical and subtropical areas and the true species which have been used in the development of these cultivars. The latter include *H. rosa Sinensis*, from Southern Asia; *H. schizopetalus*, from East Africa; *H. Cameronii*, from Madagascar; *H. Liliflorus*, from Mauritius; *H. Dennisonii*, origin unknown, and the Hawaiian species, *H. Arnottianus*, *H. punuluuensis*, *H. waimeae*, and *H. immaculatus*, all whites, and the several forms of *H. Kokio*, red.

Dr. Egolf's interest in *H. Syriacus* lead to a program, started about three years ago, which included interspecific crossing with *H. rosa Sinensis*, and some progress has been made. In respect to the *H. rosa Sinensis* (chromosome complement: $2n = 92, 144, 164$) compatibility with *H. Syriacus* ($2n = 80$), the divergence is not conducive to fertilization, let alone viable seed. However, Dr. Egolf is proceeding on the theory that the complex lineage of modern hybrids is apt to have evolved various polyploid individuals, which along with possible polyploidy induced chemically or by radiation, could increase viable seed possibilities. Accordingly, he has assembled a large collection of varying hybrids for *H. rosa Sinensis* and closely allied species for cytotaxonomic investigation and resultant determination of parental potentials.

The data compiled by the National Arboretum project could very well have direct application in our effort, but while Dr. Egolf has been making informal reports to those interested in his program, it will apparently be several years before a definitive report can be made.

For the present, then, the LASCA project will have to rely largely on our own research and experience, plus such information from other sources which may emerge along the way. Some laboratory investigations such as histologic examinations of stem structure as a guide to plant hardiness, rooting potential, etc., would certainly speed up our seedling evaluation. Also, a greater knowledge of the reasons for intervarietal and interspecific incompatibility would be of immeasurable value.

But due to limits in facilities and personnel, a full scientific program, such as is being conducted at the National Arboretum, is not contemplated at Arcadia at this time. Our work will be confined to simple breeding and selection of cultivars which are more suitable to our climate than those now available, not only in growing habit, but in color, form, and bloom life.

Our program does have certain practical advantages, however. We have available for guidance, written records from our files of results secured in thousands of crosses, and observations of the characteristics and behavior in a breeding program of many hundreds of true species and hybrids from all parts of the world which have passed through our test plots for evaluation. Also, after careful selection, we have a collection of our own hybrids on which there is a parentage history of up to five generations, plus a fine group of hybrids and true species from other areas which have proven valuable in our own breeding program. Our records on this material are such that we are able to determine, to a reasonable degree, probable results of any particular crossing. We also have some hybrids which, in our opinion, are ready for introduction. And our 1962-63 "crop" of seedlings, 750 in number, is promising.

Despite all of the practical experience available to our project, it is not easy to carry forward a breeding project such as ours. As we have indicated in our discussion of Dr. Egolf's work, the complex genetical background of *H. rosa-Sinensis* and the high degree of intervarietal incompatibility slows down our work. But the primary problem in Southern California is climate.

While it may be heresy for a Native Son to say so, our climate is not the best for hibiscus. For optimum development, this plant (and particularly the highly developed hybrids) thrives best in areas where nights are warm, humidity is high and year 'round temperatures are such that soils never become cold or water-logged. Thus our frosts, and particularly the progressive lowering of soil temperatures through winter and spring months, is rough on root health, which, in reality, is the key to successful hibiscus development and longevity.

Due to our climatic conditions, hibiscus will not set seed in the open in Southern California (except in rare instances, with some varieties) so all breeding work must be done in the greenhouse, under controlled temperatures. Only by maintaining temperatures between 65 and 85 degrees F. can one secure viable seed in any quantity, and this only when the humidity is high. Maintenance of these temperatures limits in Southern California is not easy during the summer and fall months even with air conditioning. We by-passed this problem many years ago by reversing the blooming season—our greenhouse "breeders" are cut back in mid-summer and forced into winter and early spring bloom. At this season, maintenance of required conditions of temperature and humidity is not difficult when adequate heating equipment and controls are available.



The 1963 "crop" of Hibiscus Seedlings, Los Angeles State & County Arboretum

But even after one screens hundreds of hybrids and such true species as are known and available, the list of individuals which are sufficiently compatible to assure desirable results is very limited. In the absence of published authoritative research on the nature of incompatibility in the species, the contribution of accepted genetical procedures will not be great. We suspect that most of these incompatibilities are those of pollen tube and grain, and include such factors as non-germination of pollen, slower rates of growth and bursting of pollen tubes.

For instance, one very stubborn barrier to crossability is length of staminal column. This characteristic appears primarily in the native Hawaiian whites. These species have strong plant and root structure, the blooms last two and three days, the petal substance is heavy and fade-resistant, and flowers are often fragrant. Thus they are highly desirable in the development of hibiscus cultivars for local planting. But these forms will serve only as male parents, a character which is often carried over into the second and third generation. One suspects that the length of the pollen tube is the barrier here, but again this has not been proven by authoritative research. Style grafting has been considered, as it has been successful with other plants, notably the *Daturas*.

Confronted with so many problems, why do we not just bring in the fine modern Hawaiian hybrids and offer them for sale here? The answer to this question brings us back to the specific reasons for the formulation of our project: over the years, many people have attempted to establish Hawaiian and other highly complex hybrids in Southern California, but with little success. The reasons why they have failed are both climatic and economic.

Because of their extremely favorable climate, Hawaiian hybridists have not found it necessary to place much emphasis on plant and root strength; they have been able to concentrate on size, color and form in bloom. Therefore, most of the modern Hawaiian cultivars do not take kindly to our frosts and our progressively cold winter and early spring soil temperatures. Even if they do persist through more than one or two seasons, the blooms are not as large or showy as when grown in Hawaii, and for the most part, bloom is sparse, over a short season. They do well under greenhouse conditions, however, and visitors to our greenhouse in blooming season are greatly impressed when they see the huge, ruffled, multi-colored beauties, highly developed hybrids not only from Hawaii, but from our own crosses. Ironically, the American Hibiscus Society nomenclature list includes quite a number of our hybrids, cultivars grown quite widely in Florida, but are not at home in the open here, where they originated. So far, only one, Ross Estey, has been acceptable to Southern California nurserymen.

In Hawaii, and other parts of the world, most hibiscus hybrids offered for sale are grafted on strong rootstock. This was the case in Southern California 30 years ago, and at that time we saw more and better hibiscus here. However, due to high labor costs, lack of experienced labor and other economic factors, local nurserymen now grow only those varieties which root easily and do well on their own root. Most of the complex hybrids are difficult to root under modern propagation methods, and do not make adequate growth on their own roots. They are, in fact, highly susceptible to "wet feet" and winter-kill is generally their fate.

So the Southern California nurseries offer, for the most part, the older primary hybrids, some of them F_1 progeny from early-day crossings in Hawaii and other areas. These are called "hedge hibiscus" in Hawaii; they are mostly simple forms which represent little change in quality of bloom since the flower was introduced into the United States 150 years ago. In fact, some varieties which are popularly grown here are the same ones described and pictured in hand colored prints in old horticultural publications of the early eighteenth century! But most of them are hardy, and are free-bloomers over a long blooming season. Furthermore, they root easily so that mass production methods can be used with them, cutting costs to a minimum.

During our early years with hibiscus, we used native Hawaiian whites, insofar as we could, in producing our seedlings, crossing them with the better Hawaiian hybrids. More recently, we have been using such of the commonly grown *rosa-Sinensis* cultivars as will serve. Unfortunately, most of the varieties popular here will not seed for us under any circumstances, and only a few can be used as male parents. Included in the sterile list are such locally adopted varieties as Agnes Gault, Brilliant, Kona and Bride. Crown of Bohemia will not seed, but under careful handling, its pollen is compatible with a few seeders. However, we do have some "oldies" which will seed and as a result, we have been able to produce seedlings which have in their parentage the native Hawaiian white and red, the large, ruffled Hawaiian hybrids, and the "oldies" so much at home here. Most of our 1962 seedling crop have this background, and we feel that from them will come cultivars acceptable to the local nursery trade.

CALIFORNIA ARBORETUM FOUNDATION, INC.

Presents

A SERIES OF LECTURES

JANUARY 24, 1964 — 8:00 P.M.

"PLANT COLLECTING IN NEW GUINEA"

Dr. George C. Kennedy

Dr. Kennedy is Professor of Geochemistry at the Institute of Geophysics, University of California at Los Angeles. He studied at Harvard University, where he received his Ph.D. in geology, and became an Associate Professor. Dr. Kennedy is the recipient of the Mineral Society of America Award for outstanding contributions to the study of mineralogy, and of several other distinguished awards in the sciences. He is the author of many published scientific writings, and is a consultant to industrial and governmental agencies.

Dr. Kennedy will present an illustrated lecture on plant collecting in New Guinea.

MARCH 6, 1964 — 8:00 P.M.

"CACTUS & GIANT TORTOISES OF THE GALAPAGOS" Dr. E. Yale Dawson

Dr. Dawson, Director of the San Diego Natural History Museum, has had wide experience in observing plant and animal life on his many expeditions over the world. His lecture on cactus and the giant tortoises inhabiting the islands of Galapagos will be illustrated in color.

Dr. Dawson received his Ph.D. at the University of California, Berkeley. He has served as Research Director of the Beaudette Foundation for Biological Research and as Professor of Biology at the University of Southern California. Dr. Dawson was awarded the Darbaker Prize of the Botanical Society of America this year. He is President of the Western Society of Naturalists. His publications include much research material on marine algae and on cacti. He is author of the recent book, "How to Know the Cacti."

APRIL 17, 1964 — 8:00 P.M.

"COLLECTING IN AFRICA"

Mrs. Valley M. Knudsen

Mr. Maurice A. Machris

Mrs. Knudsen and Mr. Machris will share the program in relating experiences of plant collecting in Africa. Colored slides will illustrate the highlights of the trip. Mrs. Knudsen is widely known for her far-reaching civic services. She has been chairman of numerous committees and has guided the work of community and national organizations. Among her outstanding contributions is her leadership in Los Angeles Beautiful. Mrs. Knudsen has been honored as Los Angeles Times Woman of the Year, has been awarded recognition for philanthropic, cultural and humanitarian achievements, and has received medals for service to the Danish people. She has traveled extensively in Europe, India, the Soviet Union, and has been three times on safari in Africa.

Mr. Machris devotes himself to a variety of civic organizations. He has served as President for Friends of the Los Angeles Zoo and for the Shikar-Safari Club. He is a member of the Beaudette Foundation for Biological Research, the Bleitz Wildlife Foundation, and the International Council for Bird Preservation. Expeditions to collect scientific specimens for the Los Angeles County Museum and the Arboretum have taken Mr. Machris to India, Brazil, Galapagos, Alaska, and on four safaris to Africa.

ALL LECTURES WILL BE HELD IN THE LECTURE HALL

LOS ANGELES STATE AND COUNTY ARBORETUM

301 No. Baldwin Avenue

Arcadia, California

FOR RESERVATIONS PHONE Hillcrest 7-8207

Growing Cymbidiums in a Shade Garden

ERNEST HETHERINGTON

Vice-President and General Manager Fred A. Stewart, Inc.

(Continued from Autumn Issue)

Cymbidiums fit in with many kinds of gardens and can be grown in soils suitable to other shade and acid-loving plants. They require a medium that is slightly acid and has a high organic content, and the drainage must be very good. Though they require lots of water during the growing season, they will not tolerate any standing water around their roots.

Most composts today generally contain many or all of the following ingredients in varying proportions:

- 1 — Leaf Mold for physical properties and food value.
- 2 — Clay-free silt sand for body.
- 3 — Garden Peat for physical properties, acidity, food value and moisture retention.
- 4 — Palco Wool (Ground Redwood Bark) for buffering action, acid pH, and general physical properties.
- 5 — Fir Bark for physical properties, acid reaction, food and moisture retention.
- 6 — Lime for proper acidity (around pH6)
- 7 — Fertilizers for food.
- 8 — Trace Elements for balanced nutrition.

If you mix your soil, make sure it is open and porous, has high organic content with an acid reaction, and that the drainage is thorough. The simplest thing to do is to plant your cymbidiums in prepared cymbidium mix which is available in 2 cu. ft. bags.

Cymbidiums have few pests; they are fortunately subject to far fewer pests and diseases than most garden plants. However, care must be taken to see that slugs and snails are kept under control, especially during the flowering season, as they can ruin a fine spike overnight. Both the powder and liquid killers are effective. Orchid scale can be cleaned off with a toothbrush and then the plants sprayed with Malathion or spectracide solution.

Red Spider is perhaps the most persistent and difficult to detect of the pests. It can be found under the leaves, where it sucks the surface sap and makes the undersides appear scratch-white or silvery, where the surface cells have lost their sap. Malathion, Kelthane, and Cygon are all effective in this situation.

There are a few rot and virus diseases found on cymbidiums. Their spread can be controlled by proper precautionary measures, such as segregating, sterilizing cutting tools and keeping the plants in good health. A good fungicide spray in late spring and fall is beneficial.

Cymbidiums can be seen growing out of doors year round both at the Arboretum and at Descanso Gardens.

Growing Notes

By GEORGE SPALDING



Loropetalum chinense shown growing over the wall (center foreground) in the Arboretum Demonstration Garden.

NAME — *Loropetalum chinense*

COMMON NAME — Chinese Fringe Flower

CLASSIFICATION — Semi-evergreen Shrub

EXPOSURE — Full sun in Coastal Areas or very light filtered shade in Inland Areas.

COLOR OF FLOWER — White

This beautiful shrub from South East China has been grown in Southern California for many years. However, it appears and disappears from nurseries and is too frequently unavailable. The probable reason is an undeserved reputation for being temperamental. This could be true while plants are in containers, but is certainly not true when planted in the garden. The important factors are good drainage and adequate water.

The Fringe Flower is very hardy. It is one of the finest shrubs for use under windows and in other places where a 3' to 4' shrub is desirable. While 3'-4' is the usual height, plants have been known to grow much taller. It is broad and spreading and can be used to hang over a low wall or bank. Pruning is simple as a light thinning is all that is required to maintain the desired height. *Loropetalum* will also respond well to shearing or formal clipping.

In the fall an added dividend is promised by the leaves which turn bright red, a few at a time—widely scattered over the shrub giving the appearance of brilliant flowers.

Peacock Lore from Rancho Days

CLAIRE CHARLES

For five years my husband, Dr. B. R. Charles, and I lived on the old Santa Anita Rancho, the home of E. J. (Lucky) Baldwin for long years. At that time there were by actual count close to one thousand peafowl. They roamed freely, accumulating annually, for Mrs. Anita Baldwin, who loved the birds, had given strict orders to protect them at all times. It was Mrs. Baldwin, who inheriting from her father, took over the actual management of the acreage that "Lucky" had once described as "A Paradise on Earth."

Strong fences with locked gates enclosed the entire rancho. Colorado Boulevard was not cut through until 1934, and the North Gate came from Foothill Boulevard to Santa Fe Station by way of a short lane from the boulevard. The old station building still stands there. It was at this point that the city council posted signs "Slow Down—Watch for Peacocks Crossing the Road" because the birds had a habit of flying up to Mrs. Baldwin's home located north on Foothill in the morning returning late in the afternoon. They did not fly high and one flew against the windshield of a car, breaking the glass. The bird landed in the back seat, giving the driver such a scare that he brought suit against the county for damages. He did not win, for the verdict was that damages could not be collected from something "... flying through the air."

The East boundary was located where the Arcadia Park and the Turf Club now stand. The West gate faced Michillinda Avenue and the South gate, just one mile from our cottage, opened on Huntington Drive. In those days to enter Arcadia from the west one drove on Huntington to Santa Anita Avenue, then turned north to the business district. The rancho was wild and beautiful, secluded and quiet, save for the peafowls' calls.

Since those days for over a quarter of a century, peacocks have been my hobby. Here is a collection of legends, superstitions, loves and hates for peacocks, that Max Muller aptly termed "The Wild Birds of Pan."

There are three distinct species of peacocks: those of India and Ceylon, such as the ones found in the Arboretum, the *Pavo cristatus* Linne; the Burma or Java bird, *Pavo muticus*; and the *Afropavo* or Congo Peacock.

Where did our peacocks come from? Mrs. Baldwin told me that in 1867 a party of sportsmen from England visited her father on the fabulous estate; knowing their host loved hunting, they invited him to join them for their trip to India. Mr. Baldwin went. He was captivated by the peafowl; when he left India he was presented with a pair of the gorgeous birds. That was the beginning. Strictest orders were given for their protection and the flock increased. Even the nests were protected if any were found. Mrs. Baldwin followed the methods her father had inaugurated. During the mating season when her men prepared to harvest the grain, she directed that the fields be searched; when a nest was discovered it was marked so that the mower could be maneuvered around it, taking care that the eggs be not broken.

The well known Indian type has the lovely metallic-blue breast and neck for the cocks, with blue tipped crest, and of course the beautiful train of ocellated feathers, while the hen is drab blackish gray or brown. The Burmese birds have a metallic-green coloring instead of the blue in the male, with the same characteristics as the Indian; but the Burmese hen has a beautiful green breast and her crest is tipped with the same color as the males.

The Congo peacock is entirely different, and the story of its discovery is fascinating. Dr. James P. Chapin, now curator emeritus of the American Museum of Natural History in New York gave me the story and the description of his birds.

He was in Africa in 1913 collecting birds for the Museum. In the hat of an African he found an old feather that he could not identify, but he obtained it. It was shown to scientists all over the world, but no one could say more than that it came from a large bird; what type was unknown. But Dr. Chapin could not forget the strange red-brown feather barred with black, nor could he find any indication of any such plumage on any other bird.

In 1936 he visited the Congo Museum in Brussels. While there he happened to pass through a large storeroom, where two large mounted birds attracted his attention. No one knew what they were, but when he investigated them one had the red-brown black barred feathers. He had found the birds he had been waiting for so many long years. Dr. Chapin knew what they were, though they were unlike any peafowl he had known. At first Dr. Schouteden, director of the museum, was incredulous, but Dr. Chapin soon proved his point. They were African peacocks. Dr. Schouteden insisted the birds were Dr. Chapin's find and that he should name them. He did, terming them the Afropavo, or Congo Peacocks.

It was a year later before he was able to return to Africa; in the meantime he met a Belgian who had enjoyed a roasted bird in the Congo forest; peacocks are gallinaceous birds and should be delectable. Then came letters from friends, giving other instances of the same birds. Roy Chapman Andrews said in one of his articles on Africa that the Congo Peacock was "one more unexpected link between Africa and Asia."

The Afropavo are shy, probably the shyest of all birds. Tales came of the birds having been glimpsed here and there in their native land and invitations were extended to Dr. Chapin to hunt through the African country. His tales of traveling through forests with his tracker, occasionally seeing a pair of the birds slipping away from humans, and the final satisfaction of obtaining six skins is thrilling.

Let me quote you Dr. Chapin's description of them: "Your admiration for the Indian Peacock is shared by me, and the Congo Peacock cannot rival it for beauty. The male of the Congo species is all black, with blue and green metallic lustre on much parts of his plumage, curious white bristles on its head, and no trace of train. The upper tail coverts are only just as long as the retrices. The female is mostly rufous, flecked, and barred with blackish; her back is metallic green. So the Congo peacock might be regarded as a duller more "primitive" kind of peacock. Closely related, none the less, to the genus Pavo."

Peafowl are long lived, and they lived long ages ago. Bones of the birds have been reported in Oligocene deposits east of the Rocky mountains. They have also been found in Europe in Miocene and in Quaternary periods. According to the Bible, King Solomon had peacocks brought from Tharshish (India today) and it is presumed he gave them as valuable gifts; one report states that he sent the first peacocks to Egypt as gifts to Pharaoh. In first Kings ninth chapter, twenty-second verse, one may read, "For the King had at sea a navy of Tharshish with the navy of Hiram; once in every three years, came the navy of Tharshish bringing gold and silver, ivory and apes and peacocks." This information is repeated in second Chronicles ninth chapter and twenty-first verse.

Peacocks were brought to Europe by Alexander the Great. He was enchanted by their beauty, as were his men also. So important did he consider the birds that he ordered death for any one who killed one. English history speaks of baronial entertainments that partook of lavishness when "Peacocks" were served; roasted whole, stuffed with fine herbs, the birds had been skinned and when brought to the table they were covered with skins, the great proud train arranged on a frame to enhance the beauty of the feast.

Here in California peacocks existed during the great age of Pleistocene. The leg bone of a peacock was found in the famed Brea Pits from which came the sabre-tooth tiger, the mastodon, and many other prehistoric animals. These pits lie adjacent to Wilshire Avenue in Los Angeles where the discovery was made by Andrew Larson, University of California geologist, three feet below the surface among other interesting articles.

In the jungle each cock has a harem of about five hens; on the rancho we found one cock that did not follow his jungle cousins. We named this aristocratic lonely cock Rajah. He refused to join with the other birds except for one, a nice chunky oldish hen that we named Lady. The only other birds we named were two males Lady hatched; they were always together as we watched them, always eating, wandering together, so we named them The Brothers.

Rajah liked Tommy, the big maltese cat who would even share his bread and milk breakfast with this one cock, but he would make a decidedly cattish fuss should any other of the peafowl try to eat with him.

Peacocks will eat almost anything but prefer seeds, grain, green leaves of some plants, small snakes, grasshoppers, and insects of many kinds. In fact they are garden helpers and will clear a garden of snails and grubs, and caterpillars. More than that, at Sunny Slope Farms, near Fort Ogden, Florida, owner George F. Russell had a six thousand acre citrus grove noted for producing exceptionally fine fruit. On the acreage there were one hundred peafowl famed for keeping the grove free of pests, even the brown-and-yellow caterpillar called the "orange-dog." So-named because its head resembles that of a dog, it was said that two or three of the greedy creatures could completely defoliate a young tree in a couple of days . . . but the peafowl took care of them.

Rajah was a lonely bird, the most beautiful of the flock. He tolerated no other peacock except Lady; even her he would not have near him at feeding time. He would not eat with the flock. Should we be a bit late with the morning feeding, he would come to the kitchen window and call, gently at first, and if we paid no attention he would call louder, still louder until came the raucous cry. Then one of us would answer "All right, Rajah," and before we could cross the kitchen to the rear screen porch where his food was stored, he would be around to his feeding place.

I never saw Rajah fight. Seldom are two males friendly, especially during the feeding time, and never during the mating period. Young cocks may fight older ones, they may fight each other, and when they do it is a rare sight. Once a fight was taking place on the roof of a building with the birds springing straight up, almost standing on their trains and at times practically leaning against each other, using spurs and beaks, fighting intensely. Finally they were both worn out, and when the losing bird lay still, the victor pushed him over the peak of the roof.

Going back to ancient times one finds that Ulysses Aldrovanus was the first to give notice to peacocks in literature. He described the Burmese bird correctly and said that Aufidius Hurcoir was the first known breeder of birds which he sold for one thousand drachma each, approximately one hundred and fifty dollars in our currency. He listed Vitellius as the first man to serve tongues and brains of peacocks at his table, but said they were found to be stringy and unpalatable. It was Aldrovanus who said "Peacocks have the feathers of angels, the voice of the devil and the entrails of a thief." Hortensius, a Roman orator is said to be the first one to kill peacocks for his table, but that others soon followed.

Ancient Greeks considered the bird mysterious. Peacocks were dedicated to Juno who according to legend set Argus, son of Inachus, to guard the cows into which ten humans had been transformed. But Hermes slew Argus, who was covered with eyes, thereupon Hera transferred his eyes to the feathers of the peacock, and that is how the beautiful train coverts originated.

Actually the train is not the tail. The tail is of twenty stiff brownish, or tannish feathers, such as turkeys have; the train is composed of the beautiful ocellated feathers that may reach four feet in length when the bird is fully grown. When the train is spread the stiff tail feathers act as a support for the one hundred and fifty feathers in the full grown train.

There is another version about the peacock's train. The seven deadly sins, never satisfied with their condition, resented the lovely color of the peacocks, so they complained to the Creator that the birds were more beautiful than any of themselves. They begged for some rare gift to compensate for their feelings. The Creator said, "Yes? I have erred in giving you too much. I shall take from you the red eye of murder, the green eye of jealousy, and the yellow eye of envy and give them to the peacocks." This was done, and that is why, so the legend goes, the birds are unlucky, because the seven deadly sins continuously follow the birds hoping to retrieve their loss of beauty.

So many legends, fears, and superstitions surround these birds. Some claim that only in Europe and America is there a prevalent superstition as to the evil influence peafowl project. Yet from Oriental countries along with admiration, in many instances reverence, come also legends of the peafowls' evil power. In many countries feathers from the beautiful trains are presented high officials as marks of honor, and they are given as tokens of friendship, and as talismans against ill fortune. But the fear of harm and bad luck to those even near a peacock feather is also common.

It was many years before the peafowl were distributed through Europe and gradually they became known for their beauty and their edibility. There was a superstition in eating them revealed in the Peacock Vow. When knights or noblemen were going forth on dangerous missions, they would invite friends to a banquet, the chief item of which would be a roasted peacock served in the frame of feathers and spread train, as was the fashion in those days. With great solemnity the Knight would stand, place his right hand above the bird and say, "To God, the Virgin Saint, to the ladies and the peacock . . ." giving his oath that he would accomplish certain things. It was understood that this was a sacred vow that could not be broken without disgrace and calamity befalling the one who used it. Each guest would be given a serving of the bird to bind the vow.

But even today there are those who will not permit a peacock feather in their homes, nor even near them. They will not stay in a room where the feathers are. During World War I Mrs. Baldwin invited some army officials and their wives from Washington D.C. to dine. After dinner we all went down to the recreation room where on each side of the fireplace were huge Ming bowls filled with peacock feathers. The wife of one of the officials stopped in the doorway with an "O-o-o-o," clasped her hands over her chest, then without a word returned to the library and stayed there refusing to join any one in the room where the feathers were.

Sir Henry Irving is said to have become much disturbed one evening when he was playing in London because, glancing through a peep hole in the curtain, he saw a lady close to the front row waving a gorgeous peacock feather fan. During our time on the rancho I once had a small ornament of the feathers made to trim a hat; several times I was asked if the feathers were not dangerous. In fact once a stranger on the street in Pasadena stopped me saying she would never put such an ornament on a hat or on anything near her!

John Gunther had been told that the Yesidis, near Mosul, had a sacred peacock that was exhibited to the populace one day in the year and that it was a holy bird, but eventually I found quite a different story. There is a group of some 50,000 living near Mosul, calling themselves Dasni; their neighboring tribes term them Yesodi. Their religion seems to be sort of a mixture of Christianity, Mohammedanism, and superstition. They do keep a peacock in seclusion, permitting him one day of freedom in the year that all who wish may see him. But he is far from being a "Holy Bird." He is supposedly the representative of the Devil; as such he spreads evil wherever he goes. They do not worship him, they attempt to propitiate him so no evil be spread in their clan.

Quite different is the reverence the Burmese Peacock receives. As an example, when Burma attained independence and the question of a flag to represent their new status came up, they chose a peacock embroidered on an orange background. It was not until after they had formed their new constitution that they changed the flag emblem, utilizing the Burmese seal taken from the silver coinage of King Mindon, in 1852.

One of the stories Dr. Beebe tells in his "Pheasants, Their Lives and Homes," is of the supposed efficiency of peacock feathers in curing disease. A Ceylon lad was suffering from a mysterious illness. A witch doctor was called; he diagnosed the trouble as the result of two evil spirits entering the child's body when he passed a pool where they were sitting. He was eating sugarcane and did not offer them a piece so his illness was their revenge.

The "doctor" commenced treatment of his patient; he pounded on a small drum and prayed long prayers, always weaving "a broom of peacock feathers . . .", always calling on the evil ones to depart. Finally he asserted the boy was cured and left after being paid for his services. Needless to say the boy died seven days later.

The Chinese have always had great respect for the peafowl; in years long past only the high born males, or some official whom they wished to honor might wear one of the train coverts. In his book, "Gods, Man and Beasts," Dr. Fernand Ossendowski tells of his wanderings in Russia and Mongolia. Once he visited the yurta of a prince, and although the official family was encamped under heavy black tents, all formality was observed. When the Doctor making a call approached close to the inner circle, two guards came forward both in heavy robes, wearing odd red caps from which depended a single train covert from a peacock. When he entered the yurta the prince, in gorgeous heavy silk robes wore an odd furry brown cap with a single long especially lovely train feather attached. There in the heavy snow, miles and miles from any habitation the peacock feathers denoted the royalty and prestige of the wearers.

According to ancient Aztec lore, to possess one of these "Mystery Birds" was to have the blessings of the gods—the gods of Good Omen, Good Fortune and Good Luck. Birds and feathers were a part of the life, tradition, and the religion of the peoples who first lived in the Americas. It was their belief that the souls of their warriors, heroes, kings, and nobles went immediately on death to a paradise in the Sun. Here they lived in glory for four years. As the crowning achievement they were transformed into birds and were free to fly to earth again. A feathered cloak was a badge of distinction and wealth. In the wedding ceremony the bride was decked in feathered garments, in addition to other finery. All this reached its highest development in 1440 during the reign of Montezuma before the conquest by the Spaniards; Montezuma was both their emperor and high priest. He kept a great aviary in which were "flocks of gorgeous tropical birds," and rare specimens of the feathered kingdom. This included peafowl.

Some Orientals believe that the eyes of the train coverts of the peacock are a sure cure for snake bites; others believe the eyes will cure rheumatism. On the other hand many of them believe that snakes cannot or will not live where there are peafowl. Dr. Beebe related that at one time he had seven peafowl in the compound where he resided in India. Never was a snake found there, although both before and after his residences there were snakes about.

We had been told that both cocks and hens would fight reptiles. We never expected to see a nest, only hoped we might catch a glimpse of the chicks when they were

hatched. However, late one afternoon while Doctor was out feeding the flock I happened to look out of a window and saw Lady apparently scratching dry leaves in a triangle made by three sycamores. As I watched, she flew over the fence to the feeding ground. I was curious so out I went, and to my delighted surprise I found that under the leaves she had so carefully scraped together were eight eggs. One afternoon I heard Lady going around the house uttering the unpleasant raucous "fear cry." Doctor was out under the big tree raking leaves with a bamboo rake. I thought Lady was acting oddly, for she never left her nest except at the evening feeding time. Doctor went around the house, Lady following him. He called me, and I reached him in time to see him lifting a large bull snake from the nest and flinging it; he said the snake was attempting to get an egg. Lady stood some eight or ten feet back, quite quiet. Doctor directed me to get a crow bar that was back in a shed. As I ran I saw the snake that he had flung had crawled back and was again attempting to get an egg. For the second time Doctor had flung the reptile; then he gave me the bamboo implement as he grabbed the iron. All this time Lady just stood. As the snake returned the third time I flung him away; Doctor came down on his head with his bar and only then did Lady come quietly forward and settle down over her precious eggs. She did not wait for the snake to be killed; the first blow that stopped it was enough for her.

Mrs. Baldwin had never seen a nest, nor any of the little ones. After Lady's eggs were hatched, all eight of them, we managed to get her and all her babies into a fairly large chicken coop adjacent to our garden. I telephoned Mrs. Baldwin and she came down eager to see the little ones. As we walked out to the coop she was a few steps ahead of us; she looked into the coop and screamed. I dashed forward and Doctor came running. There was a big snake just sliding into the coop. Lady backed in a far corner, her babies clustered fairly close to her, but not protected. Lady stood there as though paralyzed. Another snake went to his resting place.

We did not keep the little family confined any longer; nor did Lady lose one of her babies. We watched them grow until in the third year the males commenced to grow a train covert feather or two. The Brothers would amble along with only one long feather, then after a while, it seemed to be such a long time to me, there would come another, then maybe two or three more. Finally they spread their trains in full glory.

There were other enemies among the wild life creatures on the rancho: raccoons, opossums, wild cats and coyotes, to say nothing of the dogs that some times managed to get through the gates. Often in the evenings we would see some of them; one bright moonlit night there were two coyotes on our front lawn. There were birds, too; crows liked the eggs, and once in a while ravens would appear. I might mention also that there were two-legged enemies.

The strident unpleasant call is one of fear, of warning if it is differently toned. The call of courtship is not harsh, and the mother's cry to her babies is a soft, whispering tone that is delightful if one may get close enough to hear it. The babies have soft whispering cheeps like little chickens and much like the mother's answer in soft tones,

almost the exact tone.

Several years ago Mrs. Annie Mellon maintained her home in Arcadia at Fourth Avenue and Duarte Road where she had an aviary of many varieties including pheasants, ducks, peacocks and guinea fowl. She had a Bantam hen wanting to set, so she placed a peacock's egg under her. In due time the egg hatched; imagine the wee Banty with her growing chick! She stayed with the bird even though she was soon overshadowed by the growing peafowl.

Once a man caught a runaway cock. Peacocks are large and they are strong; this one could not be held, but holding him as well as he could, the chap battled for a few seconds before the cock broke loose leaving a goodly portion of his train in the astonished man's arms. Imagine his chagrin!

At the Arboretum there is a peacock who stays exclusively with the ducks and here is the explanation. It seems that a neighbor living close to the beautiful grounds found a peacock's nest in her garden, apparently deserted, so she thought she would try hatching some of the eggs. She had a duck setting so added three of the peahen's eggs with the duck eggs. In due time all eggs hatched; of course mother duck wanted to get her babies into the water. Down to the lake she led them, and in plunged the ducklings and two of the peafowl chicks. Apparently they did not realize what water was, and mother duck did not realize what kind of babies she had. The two little chicks drowned, but the third did not go into the water. Now he has lived with the ducks through the years eating with them apparently unconscious that he is the odd member of the family.

Several times we saw the courting dance; lovers of all birds find this interesting for it is a beautiful exhibition. We watched Rajah courting Lady; with gorgeous train spread, spreading wings down-curved on either side, then with waving wings came a soft rustle of feathers, low, like "... soft wind passing through reeds ..." as Sir William Jardine described it. Lady was quite nonchalant while Rajah danced, cavorted around her, turning and twisting to show his magnificent train, while she calmly went on searching for extra grain. Rajah would stop for a few seconds in front of her, until finally she capitulated.

Mr. and Mrs. Floyd Kingsley lived on the rancho: Floyd was foreman, both when Mrs. Baldwin owned it and later when the property was sold and the new owners retained him. He told me this story of a peacock's courage. The men had gathered a pile of brush in the vicinity of the stables. It had to be burned, so the man set fire to it, guarding it closely until finally it died down. Not until then did they find on the outer rim across from where they had been working a peahen still on her nest protecting it. Her tail feathers were scorched but she had never moved.

Slim, one of the employees, was returning from the upper property when a peahen flew down from the little house by the station landing right in front of him. Flapping her wings, walking back and forth in front of him, she was uttering her distress call. He realized that she was in trouble and finally she flew to the porch roof. Investigating, Slim found to his amazement that she had made her nest on the roof, hatched her babies

there but could not get the little ones down. Of course he managed to carry them to the ground and Madame Hen, softly calling the little ones about her walked down the lane that was later to be called Old Ranch Road.

English was another employee, quite an independent person and quite a story teller. When asked if the peafowl were edible, this was his reply: "A cock was killed by a Santa Fe train, found almost immediately and taken to the cookhouse. The men were never permitted to kill a bird, but here was their chance to find what it would be like to eat one. It was properly dressed and stuffed, then that bird was cooked and cooked and then cooked again. Finally they tried to serve him. What did they find? Their knives could not cut the meat, they couldn't even cut the gravy"!

There are so many interesting stories about peacocks such as the report of a bunch of train coverts found in the tomb of a Viking, undisturbed for nine hundred years; but this does not tell the age of the bird, only that the ocellated feathers had retained their beauty. Another is the story that a hen laid regularly for twenty-two years when she suddenly stopped laying, and soon attained the train and coloring of the male birds. Even the crest on her head was brilliant-blue tipped, as were her breast and neck.

The use of the peacock as a motif in decoration is another fascinating aspect such as the story of the Peacock Throne. But while we have run out of space here to talk about them, we can always enjoy the beauty and grace of these handsome birds of the Arboretum.





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LASCA LEAVES

The official publication of the California Arboretum Foundation, Inc.

Sponsors of

LOS ANGELES STATE AND COUNTY ARBORETUM

Operated by

LOS ANGELES COUNTY DEPARTMENT

of

ARBORETA AND BOTANIC GARDENS

Box 688

Arcadia, California

Arboretum Office—Hillcrest 6-8251

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SPRING 1964
Vol. XIV, No. 2

Lasca Leaves

Quarterly publication of the California Arboretum Foundation, Inc.

VOL. XIV

APRIL, 1964

No. 2

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COVER PICTURE

Mr. Ralph Cornell made this striking photo of the Queen Anne Cottage which we reprint through the courtesy of Locale Magazine. The Addressograph-Multilith Company printed it for us as a demonstration.

CALENDAR OF EVENTS

APRIL

- Monday, April 6 C.A.F. Arboretum Tour for Members and Guests. Lecture Hall.
9:30 A.M.
- Saturday, April 11 National Palm Society — All Day Meeting .
- Friday, April 17 "Plant Collecting Safari in Africa" with Valley Knudsen and
Maurice Machris. Lecture Hall. 8:00 P.M.
- Saturday, April 18 Descanso Gardens Guild's Special Spring Party and Puppet Show
for Handicapped Children. 10:00 A.M.
- Saturday, April 18 Museum Science and History Alliance Arboretum Field Trip.
10:00 A.M.
- Saturday, April 25 Iris Show of Southern California. 9:00 A.M. to 5:00 P.M.
Sunday, April 26

MAY

- Saturday, May 9 Geranium Society Annual Show. 9:00 A.M. to 5:00 P.M.
Sunday, May 10
- Thursday, May 14 Southern California Turfgrass Institute — All Day.
- Saturday, May 16 Annual Epiphyllum Show. 9:00 A.M. to 5:00 P.M.
Sunday, May 17
- Tuesday, May 19 C.A.F. Annual Membership Meeting, 3:00 P.M.
Board of Trustees, 5:00 P.M.
- Sunday, May 24 Descanso Gardens Guild Annual Spring Reception. Honoring first
family descendants. 12:30 P.M.

JUNE

- Wednesday, June 3 Santa Anita Highlands Garden Club Dedication of Fragrance
Garden Fountain.
- Saturday, June 20 Arboretum Gladiolus Show. Lecture Hall, 9:00 to 5:00.
Sunday, June 21
- Saturday, June 27 Annual Fuschia Show. Lecture Hall, 9:00 to 5:00.
Sunday, June 28

CALIFORNIA ARBORETUM FOUNDATION NEWS

The California Arboretum Foundation can be proud of the splendid work being done by several committees whose activities are spreading the influence of our organization in a substantial measure. Susanna Bryant Dakin set a brilliant standard as chairman of the Historical committee which yielded the remarkable restoration of the Queen Anne Cottage whose dedication took place ten years ago. Its major work is completed, but other committees still have their work before them.

The Social Committee under Mrs. Rudolph Richards is widening the scope of its activities and becoming increasingly important on all kinds of occasions. Dr. Samuel Ayres, Jr., has over the years brought the Horticultural Advisory Committee to the stature of an indispensable aid. Mr. Howard Bodger's work as chairman of the Sales committee has added appreciably to the revenue of the Foundation. Co-chairmen Dr. Mildred Matthias and Mr. Maurice Machris have produced a Lecture Series of wide interest, and President F. Harold Roach has given new vigor to the Publications Committee. Dr. Arie Haagen-Smit is an effective head of the Library Committee. Perhaps the most crucial committee this year is the one headed by Mr. Thaddeus Uppdegraff which is committed to raising \$75,000 for our new eating facility, needed so badly for so long and with only thirteen months in which to reach our goal or risk the loss of our franchise.

We can't decide which of the new acquisitions at the Arboretum is most news-worthy: the engaging clutch of six cygnettes growing so rapidly and amusingly under the stern discipline of their black swan parents or the shining new Multilith which sparkles in Gerry Patten's art room to add more color and clarity to all of our Arboretum doings. Both are spreading infectious delight, and you should see them!

The Board of Supervisors of Los Angeles County recently voted to grant six months leave without pay to Director William S. Stewart to enable him to accept a State Department assignment in India. He will be away from about the middle of August through the middle of February, lecturing at universities and collecting seeds and plants for the Arboretum. Accompanied by Mrs. Stewart and their younger daughter Carol, Dr. Stewart will include the International Botanical Congress (held every five years) in Edinburgh and the International Horticultural Exhibition in Vienna in his itinerary. It will also be possible for him to attend the meeting of the International Ornamental Plant Commission of which he is a member.

Honoring Valley Knudsen and Maurice Machris, the Stewarts will give a dinner for the Executive Committee of the Board of Governors of the Department preceding the lecture Friday evening, April 17.

The Annual Meeting of the Foundation on Tuesday, May 19, should bring a host of enthusiastic members to enjoy the progress reports and the annual plant distribution to members. See you then!

* * * * *

SOUTH COAST BOTANIC GARDENS FOUNDATION is watching the progress of the stucco and wood-paneled service building which is the second structure at the gardens. It is now under construction and will include an office, garage, shop, and storage facilities, and will make an ideal setting for future flower shows.

THE QUEEN ANNE COTTAGE

The more than 2,650,000 visitors who have thus far made their way through the Arboretum since it was opened have been lured by a variety of interests, but the largest single drawing card is the carefully and delightfully restored Queen Anne Cottage. On May 18th we will celebrate the tenth anniversary of the completion of Historical Landmark No. 367. Reprinted from the Summer 1954 issue of *Lasca Leaves* is this report of the occasion:

"The day dawned benign and beautiful, and closed in an atmosphere of success and care-free celebrations. May 18, 1954, was a day of dedication at the Los Angeles State and County Arboretum. It is recorded for all time on a bronze plaque given by the State of California, and placed in front of "Lucky" Baldwin's "Queen Anne Cottage" on the historical homesite of Rancho Santa Anita.

Members of the Historical Committee worked early and late arraying "Queen Anne" for her moment of glory: Mrs. John R. Mage and Mrs. Richard Y. Dakin, co-chairmen, Mrs. Ernest A. Bryant, Jr., Maurice Block, Mrs. Howard Cunningham, Mrs. Forrest Q. Stanton, Mrs. Alfred Murray, Jack Fawcett, Dewey E. Nelson, to mention only the portion of the Committee most active in the day's preparations. During the brief speeches, credit was given where credit was due. Mrs. James Greer, Regent of the Santa Anita Chapter, Daughters of the American Revolution, was introduced, and she presented a second monetary gift from this organization, anticipating the restoration of the Hugo Reid adobe built in 1839, now in a state of dis-repair. Supervisor John Anson Ford, Chairman of the Los Angeles County Board of Supervisors, introduced Aubrey Neasham, who came down from Sacramento for the express purpose of formally dedicating the Cottage on behalf of the State Park Commission.

There followed an informal inspection of the three historic buildings bordering the Lake—then "regalement" on the lawn, and singing of old favorites harmonized by four pretty "Crown City Coronettes" to gratifying applause. And so, "Queen Anne Cottage" intended by "Lucky" Baldwin for entertaining when he built it in 1881, resumed its true role, becoming, furthermore, Historical Landmark No. 367 in the State of California, on a sunny afternoon in 1954."

With Mrs. Richard Y. Dakin as the inspiration for the project, Mrs. John R. Mage as her energetic co-chairman, and Maurice Block as consultant, a common enthusiasm as well as tremendous efforts brought forth a very human, not at all formal, historical museum. Chatting with Mr. Block recently, he emphasized that the generosity and good will of so many people who donated heirlooms and keepsakes to the Queen Anne Cottage is an important part of the success of its restoration. We all add a note of appreciation to everyone who helped make this a place where we can feel a warm familiarity with our past.

* * * * *

THE DESCANSO GARDENS GUILD enjoyed the success of the most beautiful Camellia Show ever sponsored by the Southern California Camellia Council. That more and more people are hearing about the Gardens is shown by the dramatic increase in attendance month by month. A typical example is the increase from 34,980 visitors in February of last year to 53,230 in February of this year.

Even more exciting is the extent to which Descanso is becoming known abroad. Mrs. Judge Smith, Guild President, reports that during a recent three week period there were visitors from all but three states and from more than thirty foreign countries. The list included Mexico, Canada, Australia, New Zealand, Peru, Germany, Poland, Sweden, Panama, Newfoundland, Korea, Austria, England, France, Colombia, Brazil, Argentina, Italy, Japan, Costa Rica, Denmark, Finland, Iceland, Israel, Burma, Trinidad, and Russia.



Arbor Day Observation at South Coast Botanic Gardens featured a program climaxed by tree-planting ceremonies. Here youth group members lend a hand to S.C.B.G. Foundation President Frances O. Young, Supervisor Burton Chase, and Dr. William S. Stewart (R. to L.). Similar ceremonies marked Saturday, March 7, at the Arboretum and at Descanso.

Youth Education in Botanic Gardens

M. GERTRUDE WOODS

In the fall of 1957 the Arboretum held a seminar featuring the work of Frances Miner of Brooklyn Botanic Gardens on childrens' gardens, and thereby hangs the tale of the development and growth of a unique educational program for youth throughout Los Angeles County based on Horticulture and Nature Study.

The need for such a program had been established in the minds of Administration and a few classes had been explored, but there were no rules, no precedents, no budget! The only beginnings were the old temporary Administration Building—some good soil—a director chosen to lead the project—and a big beautiful green light!

Now, after six years, much has been added—a small building for a Junior Museum, a fine 40 foot automatically controlled greenhouse, gift of the Casamajor family, and the extremely thoughtful and generous gift of \$1,000 to complete the potting yard, to be used as needed. We have a stated purpose, a clear sense of direction, an established curriculum for workshop classes and a highly-rated School Field Trip operation. Our first brochure is in print.

The Youth Education extended and expanded to include Descanso Gardens when it came into the Department in the summer of 1958. As soon as South Coast Botanic Gardens is ready, School Field Trips and classes will be scheduled there. Los Angeles City Schools Science Supervisors have already been there with us on an evaluation and planning trip.

School Field Trips serve by far the largest number of children. Subject outlines carefully prepared for a specified route through a certain area of the Arboretum or Descanso Gardens are sent in advance to the teacher as a confirmation of her scheduled trip and as a preparation outline for use with the class. These trips are graded to elementary but are easily adjusted by competent leadership for primary or junior high levels; 90% covers grades 4, 5, and 6.

The *Nature and Conservation* trip is a walk from the Display Garden through the Asian Section, around the "natural" Upper Lagoon and into the Junior Museum. Through observation and discussion children learn of the cistus and the research on fire-retardant plants while within sight of the chaparral and mountain watershed. They inspect and discuss plant adaptations, trees and grasses and their importance to mankind. Around the lagoon, the ecological viewpoint is emphasized while watching for waterbirds, turtles, frogs, fish and pond plants. The Museum shows children's projects suitable to a classroom and specimens relevant to ponds and gardens.

The *Plant Science* field trip begins at the Weather Station to consider climate and plant distribution. Then maps, charts and labels are inspected to learn where we get our plants and how records are kept. They then tour the greenhouse to observe steps in propagation practices, see tropical or unusual plants and see plant scientists at work. After a walk through the lath house and nursery, they return to their bus via the Australian Garden to glimpse the Arboretum.

The *Early California History* field trip is taken through the Historical Area in chronological order. First the Lagoon, its geological history, its plant and wildlife; then to the Indian wickiups for a look into the Gabrielino way of life; then into the patio of the Reid Adobe to consider pioneer life without Sears and Safeway. The class then goes to the Baldwin Carriage House, learns of Baldwin's agricultural achievements, inspects the blacksmith shop and the current historical exhibit.

The *Insect-Plant* field trip is relatively new and is based on the Comstock insect collection housed in the Lecture Hall, and on the observation bee hive in the Rotunda. Afterwards, a

walk to the African Gardens gives ample opportunity to observe insects and insect signs.

The *Weather Station* field trip is a far more specialized experience in that the components of weather and the instrumentation is thoroughly observed and discussed. Weather charts and maps are shown and explained, and time is taken to make observations of temperature, air movement and sky cover outside enroute back to the bus. This trip is currently being evaluated for use by groups of "gifted" 6th to 8th grade children.

All of the above trips and the outlines for them are reviewed and improved each year. More requests come in than can possibly be scheduled. During the past fiscal year, at the Arboretum alone, 17,531 children with 451 teachers had the advantages of this experience. In the six year period 2,523 teachers and 107,944 children from 72 cities have come to know the Arboretum and a considerable number return with family or friends. Many of these children, at the minimum a bus load a day from Central and Eastern Los Angeles, may have had no other opportunity to get out of their asphalt environment; thus personal experience makes *knowledge about* mountains, trees, and plants become *knowledge of* reality; history becomes people living in wickiups, adobes or "Queen Ann Cottage."

The heart of this Youth Education concerns after school and Saturday workshop classes scheduled seasonally—four times a year—designed to give Horticultural and Nature experience to individual children aged six to fifteen years or grades one through eight. Many subjects have been explored to make the choices as to the best results for the time expended. Course outlines are continually improved by seasonal changes, project improvement and new ideas. Registration is held to fifteen or fewer to insure quality, though as high as 50% of applications may have to be "regretted."

One is continually amazed at the learning potential of six and seven year olds. For them Indoor Gardens and Plant Adventures are highly satisfactory courses. During the nine hours of *Indoor Gardens* workshop, children learn methods of plant reproduction, make succulent cuttings, collect and plant tree seeds, study soil and drainage for cuttings, pots and planters. They make a terrarium knowing they are creating a moist shady environment like the north side of Tallac Knoll. They finally transplant their own rooted succulents to a planter to take home together with their tree seedling and terrarium.

Plant Adventures is a short, nine-hour summer course. There is not enough time for growing plants, so these children make a study of the "grass family". From learning the "trademarks" of the grasses, they discover bamboo is the giant of the tribe and discuss the favorite grass seeds we call cereals. During the course they make a decorative shoji screen of graceful wild grasses, and a simple Japanese style bamboo wind chime. No adult hand does any work on a child's project, the completed work is solely their own, and therein lies great satisfaction and increased stature.

Several courses are available to children of eight to ten years. *Exploring Nature* is a flexible topic that can be tailored to the season, to the special interests generated by observation trips, and to the importance of plant knowledge in any area of study. It is here that students learn to organize their own work by making a "book" on the Plant Kingdom. They study the chart, collect specimens of each phyla on their field trips, mount them and label them. They print page headings, plan page layouts, sketch and decorate. No two are alike or even similar in some respects, but all contain a quantity of new knowledge.

Indians and Rancherias is a specialized course on Early California, planned especially to fit the 4th grader. Their all out-of-doors lessons are based on the Gabrielino Indians, the Mission Period, the Explorers and Mountain Men, the Gold Rush and Pioneer Days. Children handle and use Indian artifacts and Pioneer implements and weapons. They learn proverbs and legends of the Gabrielino and California Spanish peoples and a little of their languages. The legends and proverbs were for the early Spanish-Mexican-California children "little gospels" from which they learned many things—"El dinero va y viene—y la

amistad en su lugar"—"money may soon pass but friendship stays."

In summer, *Art in Nature* is a popular subject and offered at two levels. It is based on outdoor observations of form, lines, colors, and the natural materials available. Using them creatively produces some beautiful seed mosaics of leaf designs, plant collages portraying the venerable Wolfskill tree or other shapely tree specimens, and plant laminations with sheet plastic and Japanese rice papers.

Holiday Plant Craft, also planned for two age levels, provides a wide scope for creative ideas worked out with traditional Christmas greens, seeds and cones. The emphasis is on making and giving for the home at Christmas time. The completed projects are "judged" by qualified judges from the Administrative staff, and the "winners" are invited to an evening at the Queen Anne Cottage to decorate the tree. An extra evening is added to the course for special preparations for this great occasion; for example, for last year's cookie tree, children decorated 150 cookies and designed a nativity scene with cookies cut free hand and imprinted intaglio fashion. Oh yes, they ate some too!

As soon as the Casamajor Greenhouse was completed, a new class for Junior High students was begun—*Greenhouse Propagation*. This course deals with experiments in seed germination, cuttings, budding and grafting, ornamental pot plants, planters, and bonzais.

Flower Arranging becomes important in spring and summer especially. We have been fortunate in having volunteer instructors for many of these classes.



Gardening comes close to being the favorite, possibly because it lasts so long, and produces so much. It depends upon prolonged effort and discipline. Each of the 12 students "leases" 55 square feet of the Arboretum for 20 weeks. He thereby takes on real responsibility. Two 4-hour "blast off" planting days get the crops in, thereafter two hours a week

takes care of cultivating, fertilizing, insect control and harvesting. There is "leisure" time, too, to visit other gardens within the Arboretum and evaluate the results of a professional gardener's techniques. When harvesting begins, the perfect red and green lettuces, kohlrabi, radishes, chard, and cabbages, suddenly arouse the parental interest and gardens are started at homes for which some surplus seed and transplants are available. According to local market prices, one class harvested \$104 worth of produce, which set a new sense of value on quality work.

Life in the Lagoon rivals Art in Nature and Plant Adventures for popularity for 5th and 6th graders. It covers plant and animal life found in, on and near the Upper Lagoon, which is relatively undisturbed. All discoveries from waterbirds and turtles to microscopic beings are recorded on a small folding "bulletin board" by a well organized, color keyed layout. Each student sets up and balances a small aquarium, plants and stocks it with fish or tadpole or crayfish to observe at home. After a thorough study of fresh specimens of sunfish they make a Japanese print on rice paper and mat it for a wall decoration.

Field School courses—short, outside field trip projects are set up for summer to help reduce the number that cannot be taken in workshops.

All these courses serve 600 children a year at the Arboretum and 325-450 at Descanso Gardens. They have come from 32 different cities. Each one of these children has had 9 to 40 hours of personal experience for which there is no substitute in the process of learning. The children set a high value on Arboretum classes. Seldom has there been a dropout and many times other interests are put aside when conflict in time occurs. A staff of two at the Arboretum and one at Descanso, together with volunteer help, accomplish this.

At this time we are well into two new pilot programs involving nearby School Districts. In October 1963 a teacher who had done some volunteer teaching with us arranged with the Principal of the Clifton School, Monrovia to embark with us upon an experimental program with a class of 15 mentally retarded children of 11 to 15 years who rate 59 to 70 I.Q. We are working with them 1½-2 hours per week on school time. Classes have been observed by the Principal and Psychiatrist and results are considered noteworthy, and startling to us and to the teacher. They have caused keen interest in widening circles. This course on *Gardening Skills* is sound pre-vocational training. Our idea of teaching by demonstration of both right and wrong techniques that can be seen as well as heard is very effective. In twelve lessons this class has cleared grass and weeds, prepared soil, planted 460 bulbs of 6 species, and over-planted with 250 seedlings of iceland poppies and violas. They didn't lose one transplant. During this time the morale lifted at school and academic learning increased measurably. These children are now in the midst of vegetable gardening and are divided into groups according to known abilities.

In February 1964, at the request of the San Gabriel School District we converted the *Greenhouse Propagation* into a pilot course for gifted 6th, 7th and 8th grade boys and girls. These are of 120 I.Q. and up. We are giving basic studies in Botany and Horticulture to enable these high IQ students to pursue their developing interests here and at school. They have already learned something of classification plant anatomy and physiology, have tested soils and made soil mixes. Elaborate germination tests are underway including irradiated seeds first and second generation. They are now budding and grafting.

In addition to School Field Trips and workshops, special services are given to Youth Groups, Teacher Institutes, Student Teacher Groups by appointment. Nature Trails have been developed and the Junior Museum interests many and is open to the public.

Arbor Day Programs bring hundreds of children to South Coast, Descanso and the Arboretum, 2,600 this year. Los Angeles County Supervisors, School Administrators, Mayors, Los Angeles Beautiful Chairmen, Garden Club Directors and others attend and contribute to these programs and find them good. Each child attending the ceremony

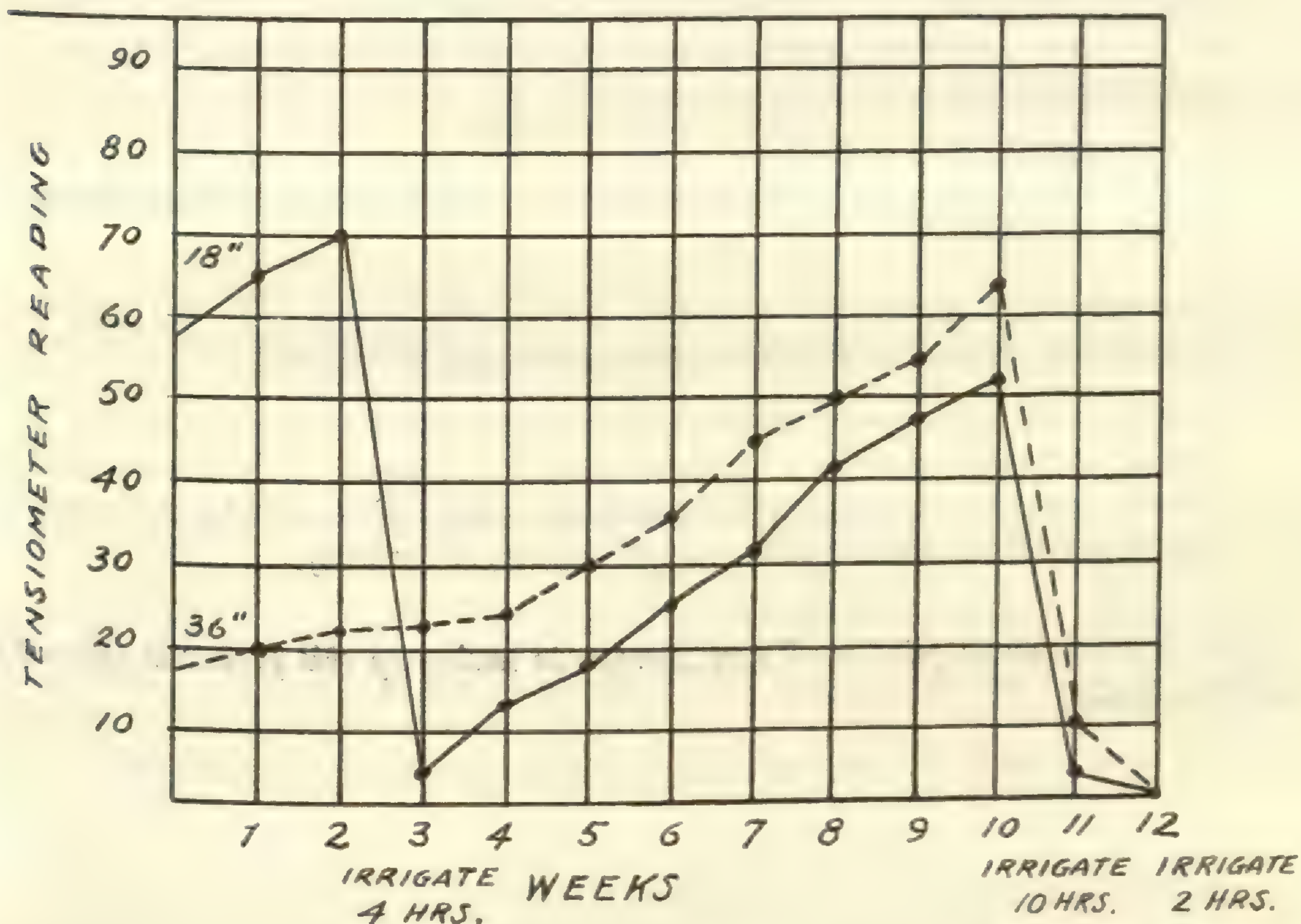
receives a tree seedling, a culture sheet, and a tree booklet. Rosedale's Nurseries and Southern California Edison Company consider it well worth their while to make this contribution of trees and books.

That green light meant "Go" and is still glowing. Without it and the full confidence and backing of the Director, the Chief of the Education Division, and the whole Administrative staff this would not be possible. What the future holds—Quien sabe?—but it will be green and growing.

The Use of Tensiometers

FRANCIS CHING

Field trials on the use of tensiometers were initiated at the Los Angeles State and County Arboretum in the spring of 1962 to determine of what value tensiometers could be in determining proper irrigation methods for trees and shrubs. The following conclusions are based on more than a year and a half of trials and the keeping of irrigation and tensiometer records on selected areas of the Arboretum (Fig. 1).



Each station consists of a pair of tensiometers, one set at 18" level and the other at 36" level. Watering is scheduled when reading registers between 0— —70 and is terminated when reading falls below 10.

1. Tensiometon can be of great value in determining the frequency, timing and quantity of water needed by trees and shrubs for optimum growth. However, a tensiometer can only be used as an aid in determining the above factors and cannot replace man's thinking ability.
2. In eleven (11) out of twelve (12) stations, frequency of watering was greatly reduced so that instead of watering on an average of once every ten (10) days during the spring, summer, and early fall, watering was only required an average of once per month. In one area, watering is accomplished once every four (4) months and at the present time there is no visible evidence that plants in the area are suffering from lack of moisture. In one area, located near a Eucalyptus tree, watering was necessary twice per month where it was previously thought necessary only once every three (3) months.
3. Although the watering frequency was greatly reduced, the actual irrigation time was stretched out to a greater period so as to avoid loss by run-off. Actual irrigation time ranged from 4-8 hours over a period of 2-4 days. Though this meant that sprinklers had to be turned on and off more frequently, a great amount of time and labor, as well as water was saved in addition to the fact that plants were not being over or under watered.
4. Light to medium rains (less than 2") will penetrate to approximately 18" over a wide range of soils but not to 36". Thus, additional irrigation was needed even though it was thought sufficient rain had fallen.
5. Although long range irrigation timing is not predictable in most cases, it is possible to determine to within 7-10 days when the next watering is needed.
6. Prolonged dry spells or very light rains during the winter months can be very misleading in trying to determine the plants' need for moisture. In most cases, the soil becomes extremely dry and almost impervious to water. Initial watering will result in a quick run off and then short but repeated watering is necessary.

(The information supplied by Wayne Morgan in setting up this project is gratefully acknowledged.)

ARBORETUM FOUNDATION BOOKS

A new book jointly published by California Arboretum Foundation, Inc., Los Angeles Beautiful, and Southern California Horticultural Institute:

FLOWERING TREES for YEAR-ROUND COLOR IN SOUTHERN CALIFORNIA

Shower trees and flame trees for Southern California? Why not? The purpose of this booklet is to present pictures and descriptions of flowering trees which are now successfully growing in Southern California, and thus to show how easily it is to reproduce in our climate the same effect of exotic color which thrills the traveller in such far away places as Hawaii, the Mediterranean, the Caribbean.

By judiciously choosing the species native to countries with climates similar to ours, we can enrich our streets and neighborhoods with the same flora of long lasting, luxurious beauty.

The trees, with their proper and common names, temperature tolerance and locations where they may be seen, are listed by seasons, showing in that way, a succession of color from January through December.

ORDER BLANK

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Flowering Tree Booklet, price \$1.50 per copy

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Imprinting of names of organization or city on book covers is available if desired. Indicate copy for imprinting here:

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Books available at the Arboretum Gatehouse or by mail order to the Foundation are listed below. Prices include sales tax but not postage on mail orders. All these titles have been reviewed by our Committee and have been approved as appropriate to the field of ornamental horticulture.

- QUEEN ANNE COTTAGE, Susanna Bryant Dakin Pamphlet. 10 cents
Historical outline of the restoration of the Baldwin "Queen Anne Cottage" which on May 18th celebrates the tenth anniversary of its dedication as historical landmark No. 367.
- ORNAMENTAL SHRUBS OF CALIFORNIA, Leonid Enari, Ph.D. Paper bound \$4.11
Cloth bound \$6.19
Useful plant identification guide authored by the Arboretum Taxonomist and currently in use in many educational institutions as a text.
- CALIFORNIA MOUNTAIN WILDFLOWERS, Philip A. Munz Paper bound \$3.07
- CALIFORNIA SPRING WILDFLOWERS, Philip A. Munz Paper bound \$3.07
- CALIFORNIA DESERT WILDFLOWERS, Philip A. Munz Paper bound \$3.07
Each of these books is profusely illustrated, many illustrations in color. Handy guides to the identification and enjoyment of our native flowers.
- EARLY USES OF CALIFORNIA PLANTS, Edward K. Balls Paper bound \$1.82
A popular booklet (illustrated) on the early California plantings.
- THE ARBORETUM STORY Paper bound \$1.56
A concise report of the Foundation's role in the development of the Arboretum, plans for the future, illustrated with colored postcards which may be removed for use.
- ORNAMENTAL TREES, E. Maino and F. Howard \$5.20
An illustrated guide to their selection and care.
- FLOWERING TREES FOR YEAR-ROUND COLOR IN
SOUTHERN CALIFORNIA. Paper bound \$1.56
See page 35 for information on this new publication.
- YOUR FIRST ORCHIDS AND HOW TO GROW THEM,
Oregon Orchid Society. Paper bound \$2.08
A handy guide for the orchid hobbyist.
- SOUTHERN CALIFORNIA GARDENS, Victoria Padilla Cloth bound \$6.19
A beautiful book, profusely illustrated with photographs of the outstanding gardens of this area.
- PALMS, Desmond Muirhead Paper bound \$2.03
Informative guide recommended to those interested in palms.
- PICTORIAL PLANT GUIDE, Sunset Plastic cover, spiral bound \$4.11
Well known, ever useful guide to western gardening.
- LOS ANGELES FROM THE DAYS OF THE PUEBLO,
W.W. Robinson Paper bound \$1.56
Comprehensive guide to historical landmarks of Los Angeles County.

A Preliminary Clarification of Lycaste Macrophylla

J. A. FOWLIE, M.D.

For the past several years the Arboretum has been developing an orchid research collection under the guidance of Dr. William Stewart and Glenn Hiatt, which, by the importation of jungle-collected materials and plant exchange, has become the world's third largest living collection of orchid plants for scientific study. These materials have been carefully tended by Joe Lerchenmuller and many species, previously considered "lost" to science have been rediscovered along with some totally new species. The present paper based on materials in the Arboretum Research Orchid Collection will serve to introduce the nature of these studies to the public.

Introduction: During the course of preparing a comprehensive monograph on the genus *Lycaste* Lindley, it has been necessary to undertake a revision of the *macrophylla* alliance. As here defined, this alliance consists of those usually evergreen *Lycaste* species with obscurely armed or unarmed pseudobulbs from the mountainous areas of Chiapas and Guatemala through Costa Rica and Panama to Peru and eastwardly through the Guianas, which have spatulate callosities, and nonfimbriated labella with usually greenish to dull brown sepals.

Thus defined, we include the Guatemalan *Lycaste skinneri* (Batem. ex Lindl.) Lindley, which ranges into Chiapas and represents the only one with bright white to cream sepals in the group. Also included are the three closely related *Lycaste dowiana* Endres & Rchb.f. from Nicaragua and Costa Rica, *Lycaste xytriophora* Linden & Rchb.f. from Peru, Ecuador and probably southern Colombia and *Lycaste powellii* Schlechter from Panama, all of which have spines on the apices of their old pseudobulbs (although the spines may be small) and usually flower on the half-matured new growth. The final two members are *Lycaste leucantha* (Klotzsch) Lindley from Costa Rica and northern Panama and the abundant and numerous subspecies of *Lycaste macrophylla* (Poepp. & Endl.) Lindley, the latter imparting the name to this alliance by its prior publication.

Lycaste macrophylla as here defined consists of those sub-species from Costa Rica to Peru and eastwardly through the Guianas which are totally unarmed on the apices of the old pseudobulbs and which flower on the matured new growth, formed the previous growing season with or without a distinct period of rest. Further, the subspecies of this concept occupy adjacent ranges geographically and are not sympatric except in certain regions where their accidental coming together has resulted in "hybrid swarms." Also, they invariably have greenish to dull red brownish green sepals.

We may thus separate the Chiapas-Guatemalan *Lycaste skinneri* which has brightly colored sepals and is far removed from the mountain ranges of the subspecies of *Lycaste macrophylla*. Further excluded are *Lycaste dowiana*, *Lycaste xytriophora* and *Lycaste powellii* whose older pseudobulbs are distinctly spiny and whose flowers are borne when the new

growth is half matured or near the end of ripening, and which grow sympatrically amongst the subspecies of *macrophylla* with little usual tendency to interhybridize with them. Closest related of all but still distinct is *Lycaste leucantha* which, although it has all of the features of the *macrophylla* subspecies, grows sympatrically with at least two of them and shows no tendency to hybridize with them, suggesting that its speciation has been effected by a different insect pollinator. It would appear that *Lycaste neglecta* Schlechter represents the analogous Bolivian form which is as white as *Lycaste leucantha*, but which must have been derived from a different subspecies of *macrophylla*.

THE SUBSPECIES OF *Lycaste macrophylla*

Although, in the past, botanists (including myself) have frequently treated the *subspecies* of *macrophylla* as *varieties*, the present evidence no longer allows the continuance of this position. Indeed, the separate members are not simply color or structural variations, but instead are very different florally and vegetatively from their allies. There are almost sufficient differences in them to warrant treating them as separate *species*, except for their lack of maintaining their integrity in ranges where they are known to overlap and be sympatric (without the production of natural "hybrid swarms"). Since our excluded species already listed are able to maintain such integrity in spite of their sympatric distributions, we cannot in all honesty elevate those forms which cannot to full species status. Therefore, I will treat as *subspecies* these components of *Lycaste macrophylla* and make the necessary transfers of their literature, thus reserving different geographical distributions which nowhere overlap, and different times of flowering as *subspecies* characteristics. As has been shown elsewhere, such a position amongst the unifoliate and bifoliate *Cattleya* species would be unwieldy and would further add to an already badly confused literature along with making hybrid registration as we know it practically an impossibility. This situation is not the case in *Lycaste macrophylla*, however, whose components may be considered as *subspecies* in the process of evolving into *species*, their differentiation as yet not completely effected.

History: As early as 1836, Poeppig and Endlicher, writing in *Nova Genera et Species Plantarum*, described and illustrated as "*Maxillaria macrophylla*" the plant which Lindley formally and subsequently transferred to his newly created genus *Lycaste* in *Botanical Register* for 1843. He had mentioned the new combination in the same periodical in 1842. Although their drawing was poor, fortunately the locality which they cited was so accurate that no confusion was left as to what form was meant initially by Poeppig and Endlicher as their type. Accordingly, the very ugly, rather abundant plant from Peru and Ecuador which has greenish sepals tinged red within that doesn't open fully has been established as the type for the species and subspecies.

Without much difficulty, one can distinguish almost at a glance the different *subspecies* which have been pictured and described in the literature since Lindley's transfer. A search of this literature together with returning to the countries in origin and review of the types has allowed the following reduction of the synonymy. Plants from the Arboretum Research Collection at Arcadia collected by myself and Glenn Hiatt have been used in determining these relationships.



1. L.m. desboisiana; 2. L.m. puntarenasensis; 3. L.m. xanthocheila;
4. L.m. panamanensis; H. Hybrid (desboisiana x puntarenasensis).

Map showing distribution of Costa Rican and Panama forms of *Lycaste macrophylla* Lindley. Note the hybrid swarm of subs. *desboisiana* x *panamanensis* (H) produced when pollen bearing insects from upper elevations of Valle de General in Costa Rica have been blown over the continental divide by intertropical convergence currents during the hurrican season and accidentally caused hybridization in the *desboisiana* populations North of Volcan Chiriqui.

Lycaste macrophylla (Poepp. & Endl.) Lindley*panamanensis* J. A. Fowlie *subs. nov.*

Planta—verosimiliter subspecies *desboisiana* Cogniaux sed habitu paulo minoris. *Pseudobulbi*—caulescenti, elliptici, compressi, cum 5-7 cm. longis $\times$ 4 cm. latis, nudi ad apices. *Folia*—fermo duo, ad 40-50 cm. longis $\times$ 10-14 cm. latis. *Flores*—ferme 2-5, in autumnno ex pseudobulbo maturado recens sine otio nati, 7-8 cm. latis et sine odore. *Ovarium*—pedicellatum, 8-13 cm. longo, per bracteam superam occultum. *Sepala*—ovata late, 4.5 cm. longis $\times$ 2.5 cm. latis, viridia rubido-fulva suffusa cum apicibus viridis. *Petala*—ovata anguste, 4.2 cm. longis $\times$ 2 cm. latis, cum apicibus recurvis, alba immaculata (aut porpe immaculata). *Labellum*—trilobum, cum apice reflexo, 3.8 cm. longis $\times$ 2.4-2.8 cm. latis, cum callo spathulato intus concavo, album intus subtiliter cum minutis punctis rubidis maculata sed cum midlobo immaculato albo puro sine punctis.

F62P8—Specimen from El Valle de Anton, 3,000 ft. Cocle Prov., Panama. Type deposited in Herbarium at Los Angeles State and County Arboretum at Arcadia.

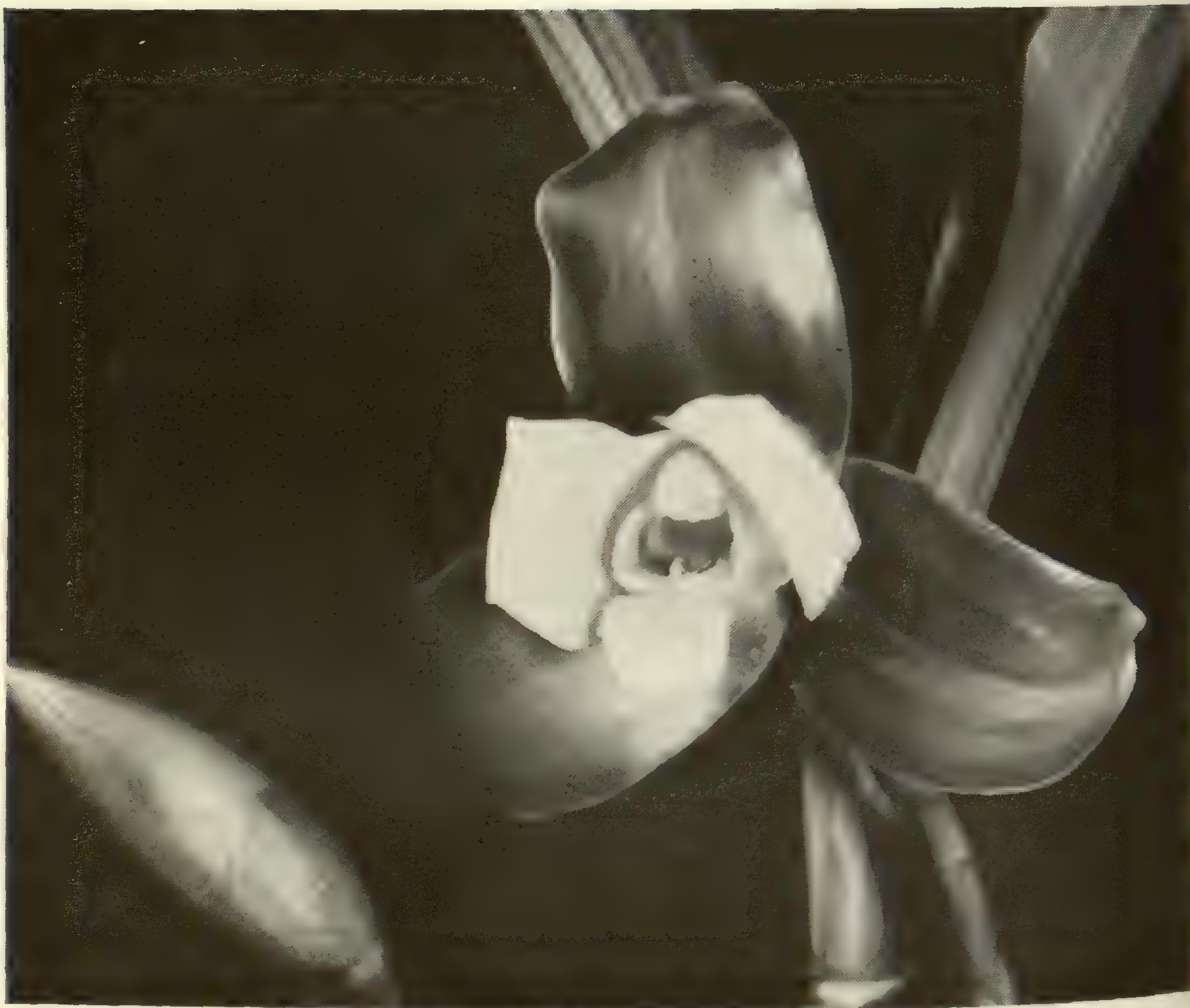
It should be noted that the flowers of subs. *desboisiana* from Costa Rica have much larger leaves and pseudobulbs, are of lighter green coloration and are borne usually in early spring after a distinct period of rest. Further, the flowers of subs. *desboisiana* have bright red spotting on the petals and reflexed portion of the midlobe of the labellum . . . entirely unlike the present concept.

It should also be noted that this subspecies is not like the one cited for Chiriqui province of Panama. Collections by Alex Hawkes at Laguna de Chiriqui show intergradation between *desboisiana* and *puntarenasensis*, and this seems the primary form of the species from the Chiriqui highlands, rather than a distinct endemic race.

Subs. *plana* Lindley—This race is Peruvian, although its prime habitat has never been rediscovered to my knowledge. Lindley mentions a Bolivian locality in another entry and describes it as having "sepals of deep rich madder red inside, and petals are richly tipped with crimson." I have never seen any species like his illustration in *Bot. Reg.* t. 35, 1843. Possibly *measuresiana* represents merely a spotted color variety of this subspecies.

Subs. *puntarenasensis* J. A. Fowlie, M.D. *subs. nov. prop.*—This race was discovered in company with Ralph Spencer on the Southern Costa Rican frontier in March, 1962. Out of flower and wholly deciduous in the dry season, it flowered the following fall and the accompanying plate was prepared by Mrs. Patricia Roberts showing its features. The flowers are very large and showy with uniform light olive sepals tipped light green, white petals suffused bright rose red distally and an unbelievable bright cinnabar red labellum. The plant is very exceptional and undoubtedly will yield some interesting hybrids. The type locality is 3450 ft., 3 Kb. W. of Los Altos de San Juan, approximately 15 mi. W. of San Isidro de General, Costa Rico. This area is in the old Cordillera Brunquena mountainous zone of Puntarenas, wherein the plant occurs. It is the only subspecies I know which is totally deciduous in the dry season (Dec.-April).

- Lycaste macrophylla* (Poepp. & Endl.) Lindley, *Bot. Reg.*, Vol. 29 misc. p. 14 1843
 Basionym: *Maxillaria macrophylla* Poeppig & Endlicher, *Nova Genera et Species Plantarum* I
 p. 37 t. 64 1836
- subs. *desboisiana* Cogniaux, as *Lycaste macrophylla* var. *Desboisiana* Cogn.
Chron. Orch. No. 1 p. 4 1897
 and as *Lycaste macrophylla* var. *Desboisiana* Cogn.
Icon. Orch. pl. 1.3a June 1897
- Rchb.f. as *Lycaste macrophylla* Lindley
Beit. Orch. Cent. Amer. p. 28 1866
- De Wolfe, Jr. as *Lycaste macrophylla*
Amer. Orch. Soc. Bull. fig. p. 335 1953
- subs. *filomenoi* Schlechter: as *Lycaste Filomenoi* Schlechter
Fedde Repert. Beih. 9 p. 100 1921
- Mansfeld, as *Lycaste Filomenoi*
Fedde Repert. Beih. 57 t. 124 1929
- subs. *macrophylla* Lindley: as *Lycaste macrophylla* (Poepp. & Endl.) Lindl.
Bot. Reg. Vol. 29 misc. p. 14 1843
- Rchb.f. as *Lycaste macrophylla* Lindley
Walper's Anns. Bot. Syst. Vol. 6 p. 602 1861
- Morren, as *Lycaste macrophylla* Lindl.
Annls. de Gand. Vol. 4 t. 221 1848
- Cogniaux, as *Lycaste macrophylla* Lindl.
Fl. Bras. III p. 457 1898
- Schlechter, as *Lycaste macrophylla* Lindl.
Die Orchideen p. 409 1914
- Schweinf., as *Lycaste macrophylla* (Poepp. & Endl.) Lindl.
Orch. Peru p. 646 1960
- subs. *measuresiana* Williams: as *Lycaste plana measuresiana* Williams
Orchid Album Vol. 7 1.306 1887
- Sander, as *Lycaste macrophylla*
Orchid Guide p. 106 1901
- Barnes, as *Lycaste dowiana* 'Dowiana Jo' Auct. Non Endres & Rchb.f.
Orchid Digest Vol. 26 Cover 1962 (July-August)
- subs. *panamanensis* J. A. Fowlie, M.D., subs. nov. prop.
- Allen, as *Lycaste macrophylla* Lindley
Annls. Mo. Bot. Gard. Vol. 36 p. 76 1949
- Hawkes, as *Lycaste macrophylla* forma *dowiana*
Orchid Journal Vol. II p. 51 1953
- subs. *plana* Lindley: as *Lycaste plana* Lindley
Bot. Reg. misc. p. 85 Vol. 28 1842
- and as *Lycaste plana* Lindley
Bot. Reg. misc. p. 15 Vol. 29 1843
- and as *Lycaste plana* Lindley
Bot. Reg. t. 35 Vol. 29 1843
- Rchb.f., as *Lycaste plana* Lindl.
Walper's Anns. Bot. Syst. Vol. 6 p. 602 1861
- subs. *puntarenasensis* J. A. Fowlie, M.D., subs. nov. prop.
- subs. *xanthocheila* J. A. Fowlie, M.D., subs. nov. prop.
- Subspecies novarum non descriptarum
- Dunst. & Garay, as *Lycaste macrophylla*
Orchid Venz. I p. 204-205 c fig. 1959
- Warner & Williams, as *Lycaste plana* Lindley Auct. Non Lindley
Orchid Album Vol. V t. 230 1886



Lycaste macrophylla (Poepp. & Endl.) Lindl. subs. *panamensis* Fowlie
F62P8 El Valle de Anton, 3,000 ft. Cocle Province., Panama

A Revision of the Subspecies of *Lycaste macrophylla*

Following the plates, descriptions and types of the authors who initially described the plants in question, it is now possible to recapitulate which forms were meant, correlating their information with our living collections of flowered material.

Subs. *desboisiana* Cogniaux—This race is almost wholly Costa Rican in origin. It is unknown by Mr. Heller from his extensive Nicaraguan collections to the North. It is a very well marked form with green sepals and petals suffused dark red brown, white petals variously spotted blood red with clear margins and a labellum with a white ground color "zoned" by a central longitudinal clear area on either side of which is heavy red shading formed by coalescence of the spotted portions laterally. It seems wholly an Atlantic watershed species and may reach Northern Panama. Recently it has been imported from Clarence Horich.

Subs. *filomenoi* Schlechter—This race occurs in the lower areas around Moyobamba, Peru. Its color s are described by Schlechter as "... the sepals are brownish suffused with green apices. The petals are yellowish sparingly dotted with red with a heavily red spotted yellow lip." This variety is very close to the typical form and has recently been imported by the Osprey Co. Like the preceding, it is an Atlantic watershed plant.

Subs. *macrophylla* Lindley—This race lives in the vicinity of Cuchero, Chihuamecala, Peru. It also appears in plants from Ecuador and may range into Colombia. The flowers are the "dullest" of the group with brownish sepals, yellowish petals which may be unspotted and a small dull cream labellum, also usually unspotted. The plants seem much smaller than the Atlantic form (subs. *filomenoi*) and do not open fully. Materials of this subspecies from Peru are strongly interbred with *Lycaste xytriophora* Linden & Rchb.f.

Subs. *measuresiana* Williams—This race is particularly striking and comes from the higher elevations of Peru and Bolivia. The flowers are erect and stand straight up, unlike the pendant appearance of the preceding forms. The sepals are red brown tipped green with white petals heavily marked bright rose. The labellum is also variously spotted, and the flowers open fully, due to a shorter floral bract than the preceding form. This plant is very close to subspecies *plana* Lindley.

Subs. *panamanensis* Fowlie *subs. nov. prop.*—This race appears to represent the Southern segment of subs. *desboisiana* Cogniaux, but as will be seen, is sufficiently distinct from it to merit separation. It occurs in the upper elevations of the low ranges of Central Panama on the moist or windward sides from 1500 to 3,000 ft. It has been variously illustrated as simply *L. macrophylla* or confused with the Costa Rican *L. dowiana*. Undoubtedly, natural hybrids with the latter species occur and they flower at the same time, i.e. in early and late fall on completion of the most recent pseudobulb without any distinct period of rest. Most of the examined individuals from Cocle province where the type comes from are pure.



Lycaste macrophylla (Poepp. & Endl.) Lindl.
subs. puntarenasensis J.A.Fowlie



Lycaste macrophylla (Poepp. & Endl.) Lindl.
subs. xanthocheila J.A.Fowlie

J. A. Fowlie, M.D. *subs. nov.*

Lycaste macrophylla (Poepp. & Endl.) Lindley *puntarenasensis*

Planta—verosimiliter subs. *desboisiana* Cogniaux simila sed cum pseudobulbis multo elongatis, profundo costatis, omnio deciduosis. *Pedunculi*—elongati cum spathis brevioris. *Sepala*—coloris oleaginosaurum cum apicibus viridibus. *Petala*—alba pura media color rosarum suffusa. *Labellum*—purum lucidum color cinnabaris. *Columna*—cum notis cuneatic coloris rubidis.

Type deposited in Herbarium at Los Angeles State and County Arboretum, F62CR43.

Subs. *xanthocheila* J. A. Fowlie, M.D. *subs. nov. prop.*

A plant of this race was brought by Bob Wilson of Miami to Mr. Clarence Kl. Horich of Costa Rica, collected at 1000 M in the forests near San Vito de Java, Costa Rica. This is on the extreme SE frontier of that country near its juncture with Panama. The form is unknown to Mr. Butcher just across the border at Volcan, Chiriqui and seems restricted to a small area of low ridges between Golfito and San Vito de Java. The accompanying plate was prepared by artist Jim Danforth, showing its essential features. The pseudobulbs are much smaller than subsp. *desboisiana*, almost black and the flowers are very different. The sepals are deep tan shaded deep red brown medially. The petals are cream with bright carmen red spots, coalescing to form longitudinal bands with spotting out to the lateral margins. The labellum is deep immaculate yellow of the color of *Cattleya citrina* with a raised ornate callus trimmed in carmen red. The plant is showy and one of the most conspicuous of the alliance.

Lycaste macrophylla (Poepp. & Endl.) Lindley *xanthocheila*

J. A. Fowlie, M.D. *subs. nov.*

Planta—verosimiliter subs. *desboisiana* Cogniaux simila sed cum paulo minoris pseudobulbis, rotunatis. *Flores*—in autumnno nascantur cum paulo brevioris pedunculis et spathis. *Sepala*—coloris oleaginosaurum rubido-fusca media suffusa. *Petala*—alba profunda rubida cum linis longitudinalis coloris maculata. *Labellum*—flavum purum immaculatum.

Type deposited in Herbarium at Los Angeles State and County Arboretum, H62CR53.

Subspecies as yet undescribed.

Numerous plants from Venezuela and the Guianas of this alliance have not as yet been evaluated by myself and it is possible that one or more races may occur in these regions. Colombia seems to hold some additional forms as may Peru and Ecuador that await further exploration and collecting.

Acknowledgements: The author is indebted to Paul Hutchison and the University of California's Botanical Garden at Berkeley for their kindness in providing certain Peruvian *Lycastes* for this study.

Concluding Remarks: It would appear from the evidence that the *macrophylla* alliance represents a rather old line of plants which underwent a period of dispersal antecedent to the Rocky Mountain Construction which so changed the contour of the North and South American Continents. Following this cataclysmic construction, the separate races of *Lycaste macrophylla* have undergone isolation inbreeding and are in the process of evolving into separate species with two centers of radiation. One of these is in the Peruvian-Bolivian zone and the other in the Costa Rica-Panama frontier. Segments already long isolated in Guatemala have already evolved into the distinct *Lycaste skinneri* and it cannot be much longer before complete speciation of the remainder is accomplished as is already evidenced in their different vegetative form and flowering periods.

These references were examined but they were not incorporated: Beer, *Prak. Stud. Fam. Orch.*; Rchb.f., *Bonplandia*; Stein, *Orchideenbuch*; Linden, *Orch. Exot.*; Williams, *Orch. Grow. Man.*

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Water Resources and Irrigation on an Old Rancho

By SHERRI BERGLUND

Junior Docent in Arboretum Historical Center

A matter of great interest is the natural waters feeding the lagoon at the Historical Center. Checking with several pioneer-informants produced information advising of the numerous wells dug by Mr. Elias Jackson Baldwin during his ownership of a considerable part of the valley. Statements were given as to their location, and a general count totaled some two hundred of these artesian wells, covering some 20,000 acres of the original 60,000 (later accounts give it as 80,000) acres under Mr. Baldwin's ownership.

Irrigation in Southern California originally began with the Mission Period, but was earnestly expanded by the growing need of the California grape and citrus growers of the mid-nineteenth century. Between 1880 and 1888 some 25 independent water companies were being established within the early San Gabriel Valley vineyard and citrus belt. One of these pioneers, utilizing his natural water rights, was "E. J." Baldwin.

The water piping system, according to the Los Angeles County Department of Water Resources—1890 Report engineer, is said to be the "boldest works of its class yet attempted in the southern part of the state . . . the stream is held in a perpendicular walled gorge near one half mile in the canyon from the first bench land at its mouth." Additional pioneer data advised that, with the help of Chinese labor, "Lucky" Baldwin had set up this pipe system conveying water from the Santa Anita Canyon through some 20 miles of his valley properties. A section of these lines of wire-bound redwood staves, used for early pioneer piping, can be seen on display at the museum. This system once carried water from one of his four reservoirs to the land south of Duarte Road and was used in his farming operations. Some sections of this system are still buried under El Monte Avenue, off Duarte Road. Apparently from comments made by Mr. Dewey Butler, another Arcadia pioneer, this water system was utilized until 1925 when it was cut off and Arcadia City water supplied the ranchers. Since this section of Arcadia was owned by Clara Baldwin Stocker, "Lucky's" first child, the magnanimity of this lady, who died in 1929, seems evident. Engineering Report—1890—of the County Water Resources Division states, the water "designed to serve the lands of The Santa Anita Colony tract of about 250 acres between the two Santa Anita washes, and lands in private ownership and use on the Santa Anita Rancho, and lying west and south of the colony tract" came from the canyon whose water rights were owned in equal parts by the Santa Anita Water Company and Elias Jackson Baldwin.

Most of Baldwin's water source came from two natural springs at the canyon location. It seems that a 4" pipe at the east section of the canyon was the beginning of the system, says former Arcadia City Engineer, Mr. Earl Hopen. Informant Bruce Wetmore, surveying the area, reported, "These tunnels were diverted into east and west sections, with one in the east and two in the west, one in the west serving Sierra Madre."

From Water Resources data (1890), the system included: "a masonry dam, about three feet thick on top and five to six feet high . . . [with] a tunnel [that] was driven 40 to 50 feet through the rock point, and within this a 20 inch cement pipe was laid, and then walled in with concrete." The main line of this system was an 18000 feet long 20 inch cement pipe cut into the mountain side "in the face of an almost perpendicular cliff . . . on an excessively steep and rocky mountain slope . . . and supported on timber-truss bridge supports. Main pipe lines are laid side by side . . . around the base of the mountain, passing over a number of ravines on truss bridge-flume supports a further distance of 4800 feet, turning due south on Santa Anita Avenue, the line between the Rancho and the Colony."

The Raymond Fault is one of the off-shoots of the San Andreas and San Jacinto Faults. Tallac Knoll, later called Peacock Hill under Baldwin ownership, thrust upward during a great earth movement about 7500-5000 B.C., is part of the Raymond Fault. Such faulting often allows greater water availability, and this fact was proven by the many marshes located in and around the old Rancho area. The lagoon, upper and lower of the Rancho, now divided by man-made fill from the Baldwin Period on, is the low end of the Raymond Basin.

Evidences that a great section of the once extensive Rancho lands was marshland, was originally reported by Surveyor Henry Washington in 1853.¹ Early California Historians state that the original area at, and within the periphery of the present Eaton's Restaurant was marshland; that at the El Rancho Estates and Shopping Hub, sandy terrain with stagnant pools also merged into marshland at the Hugo Reid School area, with much surface and underground seepage flowing east and then south to Tallac.

"The east end of this artesian belt is within the undivided remainder of the Santa Anita Rancho, owned by E. J. Baldwin," says the Water Resources Engineer. "There is here a tract of 450 to 500 acres of decidedly wet or marshy land, lying in a strip near two miles long, east and west, with a maximum width of three fourths of a mile; and within, or on the margins, of which are three, more or less distinct groups of artesian springs² . . . and also a number of artesian wells.

"The cienegas and well waters are collected by little open ditches³ and, in some cases, by pipes into sixteen or eighteen small earth-embanked reservoirs and are drawn thence and distributed, chiefly through cement pipes, together with water from Santa Anita and Little Santa Anita canyons . . . in irrigation over a body of land about three miles in length, east and west, and one mile to one and one half miles wide, lying immediately south of the cienega or artesian belt, and west of the Santa Anita Colony tract . . . These are the Baldwin Santa Anita sources and irrigation."

Much more data, chronology, mapping and charts resulted from this research and are available to other students at the Center's Archival Files.

¹County Engineer's Report.

²"The El Rancho shopping center area (c. 1930)," according to Dewey Bulter, "was previously called the 'frog pond' because of the deep marshy terrain located there." Hopen: "Marshy cienegas were located not far from the Hugo Reid School."

³Dewey Butler: "Though much farming in the Santa Anita Colony area was dry farming, water for irrigation was distributed from the main rancho through open ditches until around 1915."

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* * * * *

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All about *Dichondra*



Lasca
Leaves

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COVER PICTURE

The official flower of Los Angeles, the Bird of Paradise, *Strelitzia reginae*, is beautifully depicted by the artist, Henry R. Mockel. The California Arboretum Foundation provide this reprint.

All about Dichondra

FORWARD

With this issue of *Lasca Leaves* a new editor takes over and inaugurates the policy of devoting the entire magazine to a single subject. A monographic presentation allows us to delve more deeply and more completely into the basic fund of knowledge that has been developed and reveal new facts that have been accumulated. The first subject, selected because of its unique place in the horticulture of California, is the ubiquitous ground cover, dichondra.

For the first time, scientific information about this vastly important plant is gathered together in one publication. It should serve as a handbook for all who wish to know the basic facts about a plant and why the cultural practices they apply are successful (or unsuccessful?)

When one considers that dichondra is the accepted lawn for almost 50 percent of the homes in Los Angeles and Orange Counties and, together with bermuda grass, is an important part in almost 90 percent of our lawns, we often fail to realize its recent origin. It is no doubt one of the newest, if not the very newest, cultivated plant of economic importance. Twenty-five years ago dichondra was a lawn weed just becoming recognized for its potential value as a ground cover by a few observant nurserymen. Among them was our beloved pioneer horticulturist, the late Theodore Payne, who in the September, 1939, issue of *The Santa Barbara Gardener* called attention to this lowly plant and predicted its brilliant future. The first article is a reprint of this historic document.

Knowing of the basic research on dichondra being done at U.C.L.A. by Dr. Victor Youngner and his associates, he was asked, and graciously consented, to provide the article on the History and Taxonomy of Dichondra, including the commercial seed production. Vic Youngner was born in rural Douglas County, Minnesota. He received his B.S. and Ph.D. degrees at the University of Minnesota and has been working since 1955 on the biology of turf in the Department of Ornamental Horticulture at U.C.L.A.

A native son, Stanley E. Spaulding received his B.S. and M.S. degrees at U.C.L.A. He has been well-known in the industry since he worked at Sim's Nursery which later became Bob Warner's Manhattan Garden Supply. Since 1960 he has been a laboratory technician in Ornamental Horticulture at U.C.L.A.

Dr. Hamilton Williams makes a thorough report on the physiology and morphology of dichondra as related to management practices for which we are very grateful. Ham Williams was born in Roanoke, Va. and was graduated from nearby Hampton Institute in 1933. He was granted an M.S. and Ph.D. by Cornell University in 1940 and 1944, respectively, and took advanced study at U.C.L.A. He is now Research Assistant and Turfgrass specialist at the Arboretum.

Our thanks are also due Wayne C. Morgan, Los Angeles County Farm Advisor, University of California Extension Service, for bringing us up to date on weed control in dichondra. Wayne received his B.S. degree from U.C. at Davis and has been the local turfgrass specialist since 1958. He has done more demonstration type experiments on chemical weed control in dichondra than anyone else in the state since Boysie Day has had other assignments.

No compendium of information on dichondra would be complete without the current research report on insects provided by Dr. Roland N. Jefferson and Andrew S. Deal who have our deepest gratitude for their fine contribution.

Dr. Roland H. Jefferson was born in Washington, D.C. He attended Virginia Polytechnic and was granted his B.S. and M.S. degrees there in 1934 and 1936. After study at Iowa State he received his Ph.D. in 1942. Since 1946 he has served in the Department of Entomology at U.C.L.A. and was recently transferred to UC Riverside, where he is presently Professor of Entomology.

Andrew S. Deal was born in Birchtree, Missouri. He received his B.S. and M.S. degrees at the University of California, Berkeley, and is currently working on his Ph.D. degree at Ohio State University. Mr. Deal joined the UC Extension Service in 1952 as Farm Advisor for Imperial County and in 1956 was assigned to the UCR as Extension Entomologist.

The Editor

A New Lawn Substitute

Reprint from The Santa Barbara Gardener, September, 1939

To the Editors:

I have been intending for some time to write you about the little ground cover plant which you showed me in your garden and which you said Mr. Herrmann had in his nursery. I had quite a time running this down, finding out where it came from and who is responsible for bringing it into cultivation. The name of it is *Dichondra repens*, an exotic plant belonging to the Morning Glory Family, which has become naturalized in several places in California. The flowers are purple edged with white, exceedingly small and hard to find. Each flower produces a two-celled ovary each containing one seed. The name *Dichondra* has reference to this feature (Greek Di—double, and chondra—grain).

Dichondra occidentalis found in San Diego County and on the Islands, Jepson says may be a native.

I found a small quantity of the *Dichondra repens* in a nursery in Pasadena. Upon inquiry they told me they obtained the plants from Mrs. Lawless at the Wisteria Vine in Sierra Madre, so I went over to see Mrs. Lawless, and she told me that she got it from Carl Pegler on Orange Grove Avenue, Sierra Madre. Next I went to Mr. Pegler's place, found that he is propagating it and had two good sized lawns planted with it.

Dr. Dana Bowers of the State Highway Department was here some time ago and said that he had some of it growing up north but that the stock had come from Southern California. Mr. Pegler is evidently the man responsible for putting it on the market. I saw a new lawn in Sierra Madre planted with it, and quite a few people there have heard of it and in fact some of them call it "Pegler Grass."

I found another nursery handling some of it under the name of "*Hydrocotyle*," but this of course is an entirely different plant. *Hydrocotyle rotundifolia* is sometimes used as a ground cover too, but is quite different, belongs to *Umbelliferae*, or the Carrot Family, has a leaf with a slightly lobed or scalloped edge and is of a light yellowish green such as you see in celery. Strange to say I found both these plants growing in a lawn at the California Institute of Technology in Pasadena, also in another lawn in front of a residence in Prospect Terrace in Pasadena, so that it looks as though both these plants are fairly common.

Dichondra repens makes quite a nice lawn and from a short distance looks something like clover. It needs no cutting, but must have water. Mr. Pegler had it growing both in the sun and in the shade. It is quite easy to propagate from divisions, and looks as though it is going to be a valuable addition to the gardens of California.

Theodore Payne, Los Angeles

Dichondra in California

V. B. YOUNGER AND S. E. SPAULDING

University of California, Los Angeles

INTRODUCTION

Today, almost 30 years after the first known use of dichondra for a ground cover, over 50 percent of the home lawns in the Greater Los Angeles Area are primarily dichondra. Few, however, are pure dichondra but instead mixtures with grasses, especially bermuda and annual bluegrass. The difficulty of maintaining a pure stand is the problem for the average home owner or gardener.

HISTORY

Dichondra was first used intentionally as a ground cover about 1935. In 1939 plants, identified as *D. repens*, were being grown for sale by C. J. Pegler & Son, Nurseymen of Sierra Madre, California.

However, the same species, presumably, was reported as a lawn weed many years earlier. According to one report (1), it was known as a lawn weed in Golden Gate Park, San Francisco, at least as early as 1916. Apparently it was a fairly common lawn weed used from San Francisco southward long before the first gardeners began to culture it.

Seed of dichondra was unobtainable during the early years of its use and propagation was entirely by vegetative methods. Usually it was sold as flats of sod which were cut into plugs to be set at 6 to 12 inch spacings in the prepared lawn surface. As dichondra lawns increased in popularity, many nurserymen began growing it for sale.

Popular articles and advertisements appearing at that time touted dichondra as the solution to practically all lawn problems. Claims were made that dichondra lawns needed mowing only twice a year or not at all. It was said that weeds and common bermuda would be crowded out by dichondra. Diseases and pests were claimed to be non-existent. Dichondra is still a popular ground cover today, but anyone who has maintained a dichondra lawn knows that these early claims were not true.

TAXONOMY

Dichondra belongs to the *Convolvulaceae* (Morning Glory) family, and the cultivated form is generally considered to be *Dichondra repens*.

The genus *Dichondra* may be represented in California by several native or introduced species. Jepson (2) lists only one species, *D. repens*, describing it as naturalized from the tropics and found in scattered localities. Munz (3) lists a second species, *D. occidentalis*, in addition to *D. repens*. Both species are considered to be native to California by Munz, but he questions the correctness of the identification of the cultivated ground cover as *D. repens*.

The only recent thorough taxonomic study of the genus is reported by Tharp and Johnston (4). They distinguish two subgenera as follows: fruit very deeply bilobed, the carpels usually 1-seeded—subgenus *Dichondra*; fruit entire or merely emarginate, often with two seeds in each carpel—subgenus *Capsularia*.

Included in the subgenus *Dichondra* are several species often considered to be varieties of *Dichondra repens*. *D. argentea* and *D. occidentalis* are two distinct species included in the subgenus *Capsularia*. Twelve species in all are recognized by these workers of which four or more may be in California. However, they do not consider *D. repens* as one of the

North American species, but refer to herbarium specimens from Australia and New Zealand only.

If this separation of species is justified and correct some question may be raised as to the present nomenclature of cultivated dichondra. Cytological and genetic studies are being conducted to try to clarify this question.

It may be that our dichondra ground covers consist of more than one species. Considerable variation in form and growth habit is known in our cultivated material. In the remainder of our discussion, we will be referring to this cultivated ground cover only, accepting for the present the specific name of *D. repens*.

Dichondra appears to be highly self-pollinating. Commercial seed sources may consist of collections of relatively homozygous but distinct types.

Leaf size and plant height are environmentally induced characteristics as well as genetic variations. During winter when weather is cool and days are short, dichondra tends to produce short petioles and small leaves. As days become long and temperatures increase, leaves become larger and petioles longer. Similarly, dichondra grown in the shade will have larger leaves, longer petioles and more open growth than it will in full sun.

COMMERCIAL SEED PRODUCTION

The first production of dichondra seed was in Los Angeles County about 1944 to 1946. Later, production spread to other Southern California counties and became a profitable business for a number of growers.

In the early days of seed production, the retail price of dichondra was high. The great difficulty of harvesting was the main reason for the high cost of seed. Before seed production could be practical and economical, special seed harvesters had to be constructed. For the most part, growers developed their own harvesting equipment, using various combinations and modifications of sweepers and vacuum pickers. One grower listed a price of \$5.00 for 20,000 seeds (less than one-half ounce). He suggested, however, that 20,000 seeds be used to plant 1000 sq. ft. of lawn. Over the years wholesale seed prices have fluctuated from less than \$3.00 per pound to over \$16.00 per pound, depending on supply.

Dichondra seed contains a high percentage of hard seeds. These hard seeds may not germinate until they have been in the soil for many months. A sulfuric acid dip was used at first to overcome this problem. This was not entirely satisfactory as the acid treated seed lost its viability in a short time. Today mechanical scarification is used instead of the acid treatment. The scarified seed can be stored for long periods without appreciable loss of viability.

Dichondra flowers in the spring from late March through May and June. Seed matures by late June or July. Extreme temperatures, either hot or cold, during the flowering period, will greatly reduce flower production and seed yield. Seed fields should therefore be located in areas where moderate temperatures, approximately 60° to 70°F, are normal during this flowering period.

Maximum seed yields are obtained if production fields are seeded in the spring as soon as frost danger is over. The fields will develop a thick stand during the summer and flower in the following spring. Seed yields vary greatly from a few hundred pounds per acre to as high as 2000 pounds or more. The cost of bringing an acre to first harvest may be as high as \$1000. Weed control is one of the most costly operations. Mowing at regular intervals gives good cultural control of many upright annual weeds.

METHOD OF HARVESTING

Dichondra produces one to two seeds on a short stem hidden below the leaves. As the

seed matures, the stem curves downward until the seed is in contact with the soil. Thus, the mature seed lies on the soil surface often partially covered with dead leaves and it is necessary to eliminate much of the foliage so that the seed can be dried and reached by the harvesting machines. In the past this was accomplished entirely by withholding irrigation water until the plants wilted and dried. This often required a period six weeks or longer. As a result, recovery was poor when irrigation was resumed following harvest.

Many growers today use a defoliant in conjunction with drying to shorten the pre-harvest preparation period. Two defoliants commonly used are weed-killing oils and Diquat. The dichondra fields are dried until the plants wilt and turn blue-green in color. The defoliant is then applied and after the plants wither, the leaves and stems on the surface are raked off. The direct sunlight quickly dries the seed.

Harvesting follows as soon as the seeds and stems are sufficiently dry to permit easy seed pick up. Large quantities of trash are also picked up which must be removed in the subsequent cleaning process. If the fields are to be rejuvenated, water is returned as soon as seed harvest is completed. This should be done as quickly as possible to give the plants full advantage of the long warm summer days for recovery and regrowth.

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Physiology and Morphology of Dichondra as Related to Cultural Practices

H. HAMILTON WILLIAMS
Los Angeles State and County Arboretum

INTRODUCTION

The dichondra of our California lawns, *Dichondra repens*, has been reported as being introduced in many tropic and semi-tropic areas ranging from South America, through the scattered South Sea Islands, and into Australia (1) (7). Other species, some of which appear to be native in California, have not as yet received wide horticultural acceptance.

Listings of the characteristics of an ideal ground cover usually emphasize low maintenance which includes infrequent mowing, positive resistance to invasion by weeds, insects or diseases, and a high degree of permanence. The ultimate requirement is year-round green color. Dichondra has shown considerable promise in meeting these major qualifications but quite frequently fails dismally, or it may disappear from the lawn completely. The causes of these failures have not until very recently received scientific study. This may be due to the limited use of dichondra in sections of the country other than California. Dr. Victor B. Youngner and Mr. Stanley Spaulding are currently directing intensive investigations at the University of California at Los Angeles in the ecological responses of dichondra. Their studies will contribute much to fill this void in our scientific knowledge. However, little emphasis is being given to studies of the basic physiology of dichondra by scientists elsewhere.

THE GROWTH CYCLE

Effect of Temperature

Dichondra is capable of little or no growth during periods of cold weather which we experience during our winter season. Color retention may vary from excellent to poor according to the variances of the weather and exposure. When management practices which favor vigor and growth are continued into the fall, a greener color usually results but somewhat at the expense of winter hardiness. Extensive yellowing or chlorosis may occur and persist in spite of the best cultural attention.

Color returns and growth resumes as the air and soil warm up in spring, but continues so for only a relatively short time. In April and May, a more or less serious deterioration occurs in appearance and vigor. This decline may vary from slight discoloration to a serious defoliation. Recovery follows naturally during June and the plants enter the summer in a lush state of growth. With adequate care, dichondra can be expected to thrive until the advent of cool weather in the late fall.

Physiologically, dichondra tends to accumulate carbohydrates when night temperatures drop below 60° in the fall. This results from several factors: a. A lowered growth rate proportional to the reduced production of sugars by photosynthesis; b. A reduction in cell activity which would translocate the carbohydrates from the leaves to the roots; c. A reduction in root growth and activity induced by the lower soil temperatures and the lack of translocated carbohydrates which results in reduced absorption of nitrogen and other soil nutrients; d. A lowered supply of nitrogen in the soil due to decreased activity of soil micro-organisms; e. A lower respiration rate throughout the system of the dichondra plant which would otherwise deplete the carbohydrates.



Sketch showing gross morphological features of dichondra. The flower (a) is small, axillary, inconspicuous, borne on a long pedicel, but remains hidden beneath the leaves. The calyx consists of five narrow sepals united at the base. The corolla is made up of five united petals, greenish-white in color. There are five stamens with small anthers and two styles with rough surfaced stigma. The ovary has two lobes, each of which develops into a one-seeded utricle at maturity (b). The pedicel curves downward sharply as the seed develops. The leaves (c) are kidney-shaped with entire margins, varying in width from $\frac{1}{2}$ to $\frac{3}{4}$ inch and occasionally up to $1\frac{1}{2}$ inches. The petioles vary in length from $\frac{1}{2}$ inch to 2 inches or more, often according to growing conditions and exposure. The creeping stems (d), more technically called stolons or rhizomes, develop into a dense mat and produce many tap-like roots (e). Courtesy of Gerry V. Patton and Edward Pugh, Arboretum Staff Artists.

Plants respond to this imbalance of carbohydrate excess to nitrogen deficiency in several ways: a. Some carbohydrate material is utilized in the development of thicker cell walls as cellulose or dehydrated into starch; b. The osmotic concentration of the cell cytoplasm increases, a factor which results in increased cold tolerance; c. The meristematic tissues cease the production of vegetative tissue and are stimulated to initiate reproductive tissue for the production of flowers and fruit. Thus during the cool season, low temperature is a limiting factor in the growth of dichondra. Changes in other phases of growth stimulation common in horticultural practice such as additional watering or fertilizing would have little or no effect during this dormant state.

The Inter-relation of Temperature and Photoperiodism

Temperature in the soil and atmosphere are optimum within a well defined range. Below and above this optimum, the rate of physiological activity decreases proportionately. Thus a graph showing the correlation of growth and temperature would appear as in Fig. 1.

There is a relation between day and night temperatures, the latter exerting the more critical influences. Differences in soil and air temperatures must also be taken into account.

Concurrent with this low temperature of our cool season is a decrease in the hours of daylight. From the viewpoint of phyto-physiological activity, the critical factor is the increase in the hours of darkness (5) (6). It has been suggested that the dark period favors the accumulation and activity of the plant hormone, florigen, which tends to be unstable in light. It is this hormone which stimulates the meristematic tissue of the stems to change drastically from a vegetative state to the initiation of flower primordia. Thus dichondra may be classed as a short day (long night) plant since flowerbud initiation occurs during periods of less than twelve hours of daylight.

The development of these flowerbuds, even though initiated, is delayed by the low temperature of California winter. As spring arrives, both temperature and daylength increase, accompanied by a corresponding increase in the growth of vegetative and flower buds. However, there is a differential in the rate of this growth and development. The optimum daylength for flower initiation and development occurs during a relatively short period during early spring. After this time, the ability of dichondra to initiate flower buds drops off rapidly while the initiation of vegetative buds proceeds at an accelerated rate. See Fig. 2.

Thus the initiation of flower buds results from the interaction of two environmental factors, the influence of lower temperatures on carbohydrate metabolism and the effect of a day/night length upon plant hormone production and activity known as photoperiodism.

Temperature continues to exert a strong influence on the growth rate of both flower and vegetative buds. A favorable temperature between 60° and 70° (night) occurring throughout the period of favorable day/night length results in maximum production of flowers and fruit (seed).

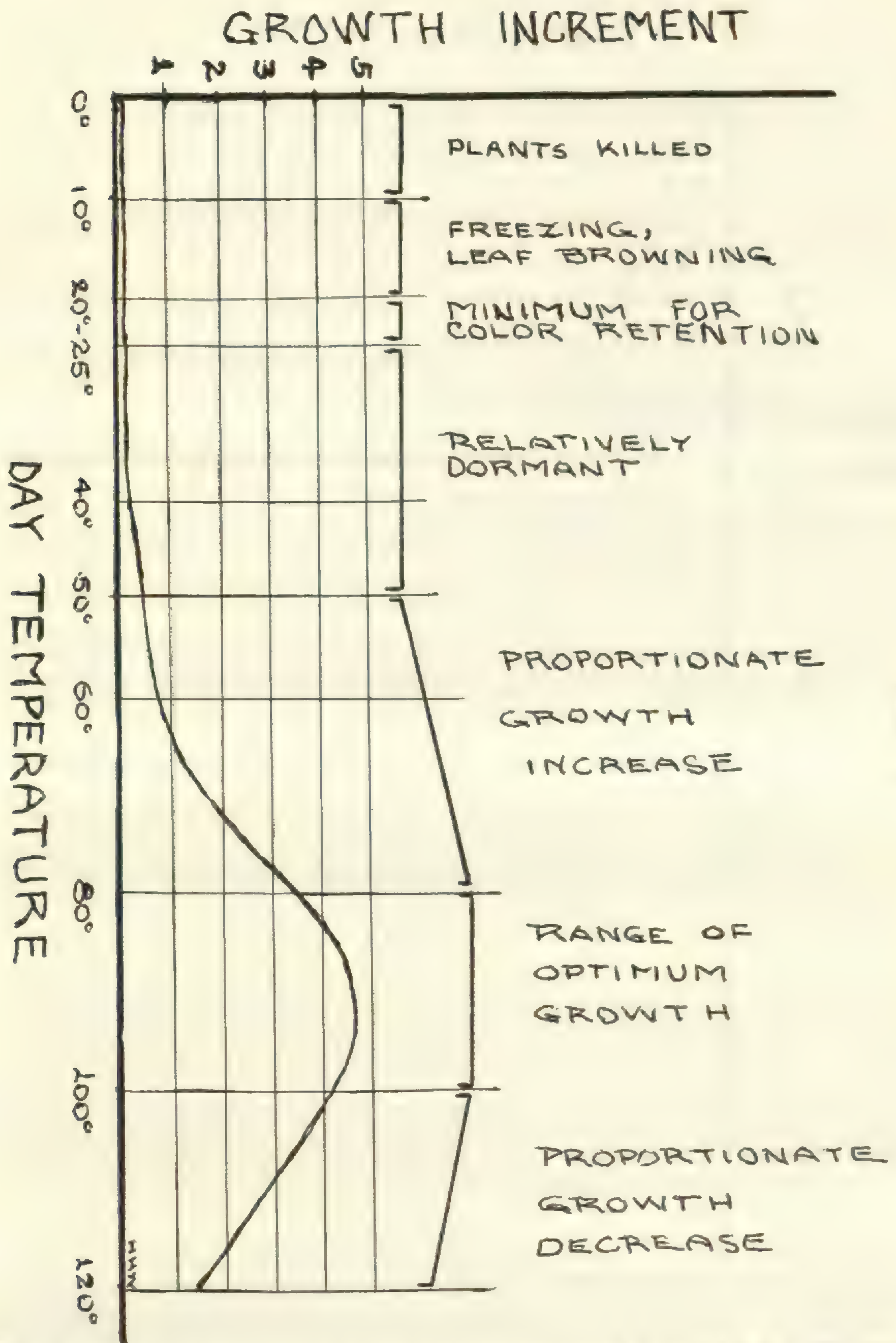


FIG. 1

Fig. 1. Graph showing correlation of growth and temperature based on available data. The curve must be regarded as hypothetical but typical. Responses of the plant to temperature ranges are also indicated.

GROWTH RATE

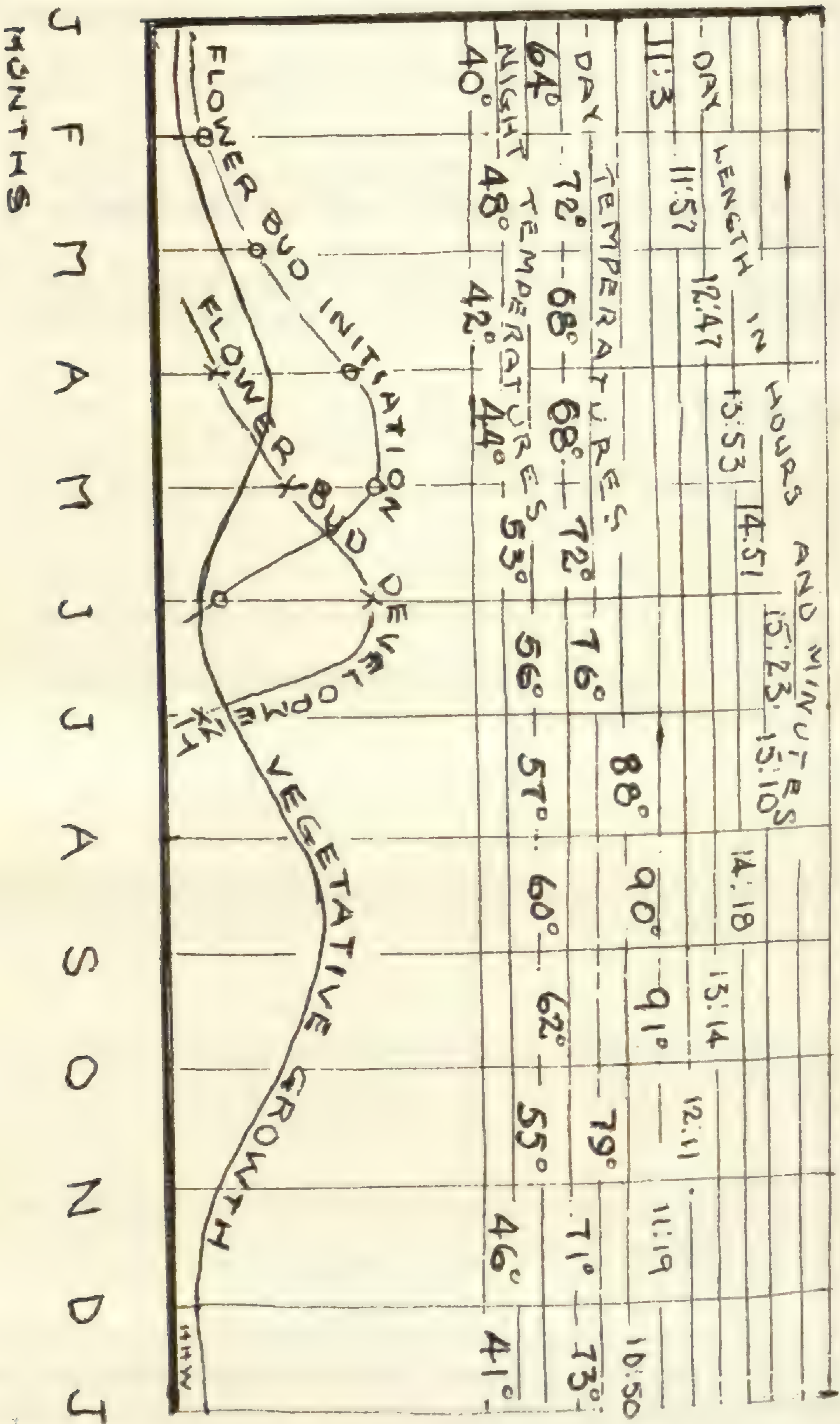


FIG. 2

Fig. 2. Graph showing inter-action of photoperiodism and temperature in influencing flower-bud initiation, flower-bud development and fruiting, and vegetative growth. Based on weather data supplied by Dan Martel of Arboretum Weather Station and Victor B. Younger of U.C.L.A.

Physiological decline at Flowering Time

Of more interest to the home gardener is the tendency of dichondra to go into a more or less serious period of decline at the time of flowering and fruiting. To better understand this phenomenon, again it is necessary to study the physiology of the plant.

As previously mentioned, carbohydrates accumulate in the leaves and stems of dichondra during the cool season as stored materials. When demanded for synthesis of the fruiting materials, these carbohydrates are in available supply and are translocated out of the leaves and stems to the regions of intense embryonic development. This depletion of reserve materials may cause leaves to become chlorotic, weaken and die in varying degrees of seriousness. It is important to recognize that during this stage, sufficient carbohydrates are probably not being produced to prevent a deficit.

When the environmental factors of temperature and photoperiodism alter to favor vegetative growth over flower and fruit production, dichondra tends to regain its verdure.

During the period of flower and fruit production, root activity is at a minimum due to the low soil temperatures which tend to lag considerably behind fluctuations in air temperature. This lack of root growth is also the result of a deficiency of translocated carbohydrates from the leaves, a condition that is not corrected naturally until late spring.

It is readily apparent that the strain of flower and fruit production is supported to a considerable degree by food reserves stored in the leaves and stems with little assistance from root activity or photosynthesis. The resumption of normal vegetative growth in late spring or early summer represents the restoration of the balance between root and shoot growth and the decline of the production and influence of flower inducing hormones.

CLEISTOGOMY AND GENETIC STRAINS

Experiments underway at U.C.L.A., conducted by Mr. Stanley Spaulding, provide an additional and a most interesting consideration to this phenomenon. Dichondra produces a high percentage of seed by cleistogomy, a process of self-pollination which occurs before the corolla opens. Seed is therefore largely homozygous and may faithfully transmit the characteristics of the parent plant. Mr. Spaulding has spaced progeny from single seeds far enough apart in rows to be able to observe individual growth habits. He has observed through successive generations various degrees of decline at the time of flowering and fruiting ranging from slight to serious and even complete defoliation. Thus the matter of the extent of decline may be a genetic factor that may be eliminated by the selection of superior and desirable strains.

Cultural practices which would tend to foster root growth, including the use of readily available nitrogen, and a favorable moisture level and air supply in the soil, are suggested as means of alleviating the seriousness of this decline. Further study may demonstrate that the use of certain growth regulating chemicals now available may circumvent this difficulty.

The work of Spaulding and Youngner at U.C.L.A. has shown that dichondra strains show wide variation in growth character, leaf size, leaf shape, length of petiole, etc. Among the various strains, these characteristics tend to persist in successive progeny.

It has been observed that similar variations in vegetative growth character may be induced to some extent by environmental factors of temperature, exposure, moisture, and fertility. Thus dichondra in the shade has larger leaves with longer petioles than that grown in full sun. The same condition would be exhibited to some degree with individual plants before they become crowded as in a lawn. However, this observation of growth habit as a genetic factor introduces another important consideration in horticultural practice.

A lawn planted from seed represents a collection of individual plants of different strains which have gradually become selected by dominance. An unmowed dichondra lawn is generally quite uneven due to the variation in height of growth and leaf size of the individual plant clumps. The practice of mowing may favor the survival and expansion of the smaller-leaved, shorter plants and eventually give rise to a more uniform stand. A new approach to this situation could well be the planting of seed from a uniformly selected strain and so eliminate the necessity for mowing altogether.



A lawn of mixed grasses including Kentucky Blue and Bermuda and some weeds has been invaded by Dichondra. The grasses at this stage are dominant in the stand. (Photo taken September, 1963).

Photo by Bobby M. Vargas

ROOT MORPHOLOGY AND SELECTIVE HERBICIDES

The emergence of the primary root at the time of seed germination proceeds as a determinate tap root to a considerable depth before branching and giving rise to a fibrous root system. The use of recently developed selective herbicides, including monuron and diphenamid, may be possible due to this characteristic aside from any consideration of physiological tolerance. These herbicides tend to become fixed in the top layers of soil where they would be lethal for shallow rooted plants and the roots of germinating weed seed.

David Mitts of Bandini Fertilizer Co. has observed that dichondra is sensitive to monuron under shade conditions while highly tolerant to concentrations sufficient to eliminate oxalis, a shallow rooted weed, when growing in full sun. This might indicate that the more shallow roots of dichondra in shade and other physiological differences induced by low light reduce the tolerance to the herbicide.

Information on the physiological tolerance of dichondra to diphenamid indicate that the use of the material may exceed the currently recommended application rate. Whereas the ten pounds per acre which is effective for shallow rooted grasses and some weeds is the recommended treatment, monthly application at this rate up to the total of fifty pounds has produced no apparent damage to dichondra. However, the deeper rooted perennial bermuda grass has suffered greatly at half this amount in tests at the Arboretum.



Stand of Dichondra practically complete, the grasses and weeds either eliminated or under control except Oxalis. This conversion was accomplished through two applications of commercially available formulations of diphenamid at recommended rates applied in late December and during April, respectively. In other tests, Oxalis in Dichondra was controlled through the use of Monuron. (Photo taken July, 1964).

Photo by Bobby M. Vargas

THE VALUE OF THE RHIZOME/STOLON SYSTEM

The development of an extensive system of rhizomes and stolons in mature stands of dichondra may be regarded as a morphological asset in horticultural practices. This system serves as a reservoir of regenerative tissue and as a hedge against drought and other adverse conditions, including freezing. Often where the entire top growth has been killed by dessication or freezing, the restoration of favorable conditions engenders regrowth from this reserve. Thus this recovery from drought and freezing is more a matter of morphology than of actual physiological tolerance, its effectiveness being proportional to the volume of the rhizome/stolon system which survives. Where shallow-rooted weeds and dodder have invaded an established planting of dichondra, defoliants and contact herbicides may be used to completely eradicate the surface growth in the affected area. This practice will generally eliminate the pests where they have not been allowed to produce seed while the dichondra will re-establish itself from the buried stolons and rhizomes.

THE IMPERVIOUS SEEDCOAT

Dichondra seed has an impervious coat that becomes a major factor causing delayed germination. Commercial seed is scarified to circumvent this problem and so permit a rapid sprouting of the seed when planted under favorable conditions. Allied with another valuable physiological asset, prolonged viability, this feature also enables dichondra to regrow after extended periods of adversity. Thus un-scarified seed will remain intact in the soil for long periods of time and retain the potential for the re-establishment of the planting.

The fleshy seed cover is palatable to certain birds which inadvertently are instrumental in the dissemination of dichondra. After passage through the digestive tract of the birds, dichondra seed is sufficiently etched to permit germination readily. This might explain the appearance of dichondra in widely separated and isolated areas where none existed before.

LOW SALINITY TOLERANCE

During the warm season, dichondra enters a period of vigorous vegetative growth accompanied by a high respiration rate. Carbohydrates are utilized rapidly with little remaining for storage. This results in a relatively low sugar content and osmotic concentration within the plant. A corresponding sensitivity to saline concentration in the soil water must be recognized. This situation may account for the disappearance of dichondra from many lawns due to buildup of excess soluble salts. This would be especially true in the hot, interior valleys where large amounts of water are required and where the water normally contains a high percentage of salt. Where water and fertilizer have been used advisedly and judiciously, dichondra has survived long periods at 100°. Enough water must be applied to percolate to below the root zone and flush out accumulated salts. Frequent, shallow watering commonly thought advisable may lead to serious difficulties. Close mowing should be avoided to favor more foliage which would lend more shade to roots, prevent more water loss directly from the soil by lowered temperature, and encourage and support a deeper root system.

SUMMARY

1. The debilitating effects of flowering and fruiting on dichondra in late spring may be somewhat altered by supplying adequate nitrogen and other elements to the soil, by aerifying to increase the oxygen in the soil atmosphere and judicious watering to maintain a favorable aeration/moisture ratio in the root zone. Water in the morning to allow the soil to warm during the remainder of the day and so enter the night at higher temperature.
2. A build-up of rhizomes and stolons may be desirable as a reservoir of regenerative tissue where top growth may be lost through dessication, freezing or in scalping or defoliation for the control of certain weeds or dodder.
3. Salinity may be a major factor in the poor growth or disappearance of dichondra in many lawns, especially in hot regions. Avoid frequent, light waterings and fertilizer practices which result in the accumulation of excessive soluble salts.
4. The use of newly developed selective herbicides such as monuron and diphenamid greatly reduces the problem of weed control in dichondra.
5. The use of growth regulating chemicals shows promise in the control of dichondra during periods of stress such as are normal at the time of fruiting.
6. Selected strains of dichondra show promise of avoiding many of the undesirable features ordinarily experienced by the home gardener and may give rise to an even stand within a lawn which will require no mowing whatever.

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The author gratefully acknowledges the assistance given by Dr. Victor B. Youngner and Mr. Stanley Spaulding of U.C.L.A. during the preparation of this article.

Controlling Weeds in Dichondra

WAYNE C. MORGAN

L. A. County Farm Advisor

The ground cover *Dichondra repens* has found widespread acceptance in southern California as a substitute for a grass lawn. This popular low-growing herb can form a dense sod in the warmer areas of the state if given reasonable maintenance.

One of its chief advantages is its ability to remain green the year round if winters are not severe. Because it has poor wear resistance and low disease, salinity, drought and compacted-soil tolerance, weed invasion can often be a problem.

The first step in weed control is to build a strong, dense turf by good management practices. *Dichondra* will respond favorably to monthly fertilization, using 1 pound of actual nitrogen per 1,000 square feet. Be sure to water immediately following application to avoid burning of the leaves.

Regular weekly mowing at $\frac{1}{2}$ " to $\frac{3}{4}$ " (slightly higher during summer in interior valleys) will help to produce leaves close to the ground and form a tight, dense mat that is resistant to weed invasion.

Mature *dichondra* will root to a depth of 12 inches or more in a fertile soil if good irrigation practices are followed. Only apply water to the upper few inches of root zone as often as the plants first begin to show a need for it. Climate and soil will dictate how often this will be. Once every two to three weeks in summer, allow the sprinklers to run slowly and long enough to have the soil wet to a depth of one foot or more. Frequent shallow irrigation will weaken the *dichondra* and encourage attacks by disease and weed invasion.

Under good maintenance practices, a few weeds may sometimes start growing in *dichondra*. Many of these will be tall and spindly and will pull easily when young. Oxalis and bermuda can be easily controlled by hand weeding in the early stages of invasion. This must be done persistently to avoid these weeds becoming established. The adjoining *dichondra* will quickly spread to heal over the disturbed areas.

Many chemicals are now available for controlling weeds in *dichondra*. It is very important to follow the directions on the label because the manufacturers have gone to considerable effort and expense to determine the best and safest use of their products. Often the margin between effectiveness and injury is only slight. Repeated applications may be necessary.

Some broadleaf weeds may be controlled by spot application of 2,4-D, wetting the leaves with a sponge or paint brush, or by placing a few drops in the heart of the weed with an oil can. Whenever the material touches the *dichondra* leaves, the plant will be killed. Most shrubs and trees are also injured by 2,4-D, so care must be exercised to see that it is applied when there is no wind and the spray will not drift to other desirable plants. Control of dandelions, plantains and bristly ox-tongue will be achieved with one application of the 2,4-D.

Oxalis and bur clover in dichondra can be killed by spraying with monuron. There are several commercial formulations of this material, so follow directions as to rate and frequency. Time of application is also important.

Annual bluegrass, crabgrass, bermuda, or other grasses can be eliminated from dichondra by using one of two chemicals. The first of these is Dowpon. For the annual grasses, use 2 ounces applied in water to 1,000 square feet of area. Bermuda and other perennial grasses are best controlled with spot applications using $\frac{2}{3}$ ounce in a gallon of water to wet the foliage. Repeat the application about one week after any new green growth may appear.

The second material for controlling grasses and other narrow-leaved weeds in dichondra is diphenamid, sold under several trade names. For the annual grasses, use 10 pounds of actual material per acre (7 ounces of a 50% material per 1,000 square feet). If bermudagrass is present use double the rate and repeat the application about one week after any new green growth may appear.

Both of these materials are slow-acting, so it may be a couple of weeks before results will appear. For controlling annual grasses, it is preferable to treat in the fall of the year before the annual grasses germinate or become well established. For greatest effectiveness against bermudagrass, the weather must be warm and the bermuda growing well, as in the spring.

When crabgrass is the only weedy grass, Betasan, or dichondra preparation of lead arsenate, or Zytron may be used in January or February before the crabgrass germinates.

When most crabgrass seed has already germinated apply disodium methyl arsonate (liquid and dry preparations are available under several trade names). One to 3 applications 5 to 7 days apart will kill crabgrass without injury to dichondra. For best results apply before crabgrass goes to seed, usually in August.

Spot killing of all weeds (as well as the dichondra) may be accomplished with the use of a new chemical, dimethyl arsenic acid, sold as Kilz-All or Weed-Out. For the bermuda and other deep-rooted perennial grasses, repeat applications about three to four weeks apart will be required. This chemical is safe to use beneath shrubs and trees and replanting may be done after 5 days.

The manufacturer of a product combining the herbicides diphenamid and trifluralin reports that this material will control prostrate spurge in dichondra but this has not been tested by the author.

How to Grow Dichondra

ROBERT E. ATKINSON

Choose dichondra for planting only lawns that receive little wear from foot traffic. This is especially true in heavy soil that compacts easily if walked on when wet. Do not attempt to grow dichondra when drainage is very poor, if irrigation water is excessively saline or if soil is extremely alkaline. It is not the most economical lawn by far, nor is it in any way a "lazy man's" lawn.

Dichondra easily survives 25 degrees but may be damaged if walked on when the leaves are frozen. It is a marginal choice in areas that regularly have temperatures below 20 degrees but can survive 12 degrees with only some leaf browning. All the leaves will be killed at temperatures of 8 to 12 degrees and the whole planting will be killed if the soil freezes from 2 to 4 inches deep.

Cool season grasses probably make a better lawn in the cold, foggy coastal region from Santa Cruz County northward. In the desert dichondra thrives best in part shade but in most of Southern California and the Central Valley it grows equally well in sun and part shade. However, in full sun it will need more frequent watering.

PLANTING NEW LAWNS

You may plant either seed or plugs but soil preparation is similar and the same as for grass lawns. After establishing the rough grade and sloping the lawn to provide surface drainage, add a layer of composted humus to the soil. If the soil is poor add more humus, up to 4 inches. If the soil is alkaline apply a soil acidifier composed of sulphur and iron and aluminum sulfate to bring the pH down to between 5 and 6. Using a rotary tiller, mix the humus and acidifier into the upper 6 inches. Water the soil thoroughly to settle and before establishing the final grade install a sprinkler system.

Seed the dichondra at the rate of 1 pound per 1000 sq. ft. or cut flats of dichondra into 1 inch squares and plant about 6 inches apart. If you want faster coverage plant closer. Dichondra seed will germinate faster and plugs will spread quicker in hot weather. Best time for planting is from April to August. Seeding is the preferred method. Seeds germinate in one to two weeks in warm weather and completely cover in 6 to 8 weeks.

If the seed bed cannot be kept constantly moist until the seed germinates by continual watering several times a day it may be covered with a thin layer of a coarse organic mulch to hold water adjacent to the seed continuously. With a mulch, a morning and evening sprinkling will suffice to keep seed moist.

Formerly the only way to keep weeds out of freshly planted dichondra was by the arduous task of hand weeding, or by the expensive methods of using preplanting chemicals that partially sterilized the seed bed. With the advent of diphenamid an effective weed control for newly-planted dichondra was available. It is used both as a weed killer alone or mixed in various fertilizers and is applied before or after seeding with no damage to dichondra.

PLANTING IN OLD LAWNS

Dichondra can be established in grass lawns by spraying the area with dalapon according to directions. In about 10 days when the grass begins to die it can be raked off and the dichondra planted in the roughened seed bed. It will take over in about 2 months if the seed is kept moist until it germinates and given adequate water and fertilizer.

FERTILIZING

Young dichondra leaves are curled into the shape of a funnel. These may hold pelletized fertilizers which make a highly concentrated solution when wet and if not washed out become more and more concentrated as the water evaporates. If a soluble dry fertilizer is used a severe foliage burn may result.

The extreme sensitivity of dichondra to salt also poses a problem, especially when metropolitan Los Angeles water or Colorado River water is used to dissolve soluble fertilizers. This water contains about 800 parts per million of salt. Add to this the 1200 p.p.m. provided by a soluble fertilizer and you approach the threshold of salt injury when concentrations reach 2000 p.p.m. Thus liquid plant foods, natural organics or slow-release fertilizers are favored for dichondra. New planting should not be fertilized until they are 6 weeks old but established plantings require 50 pounds of a 4-4-4 natural organic per 1000 sq. ft. once a month or 10 pounds of a 20-16-6 slow release material.

Dichondra Pests in Southern California

R. N. JEFFERSON AND A. S. DEAL¹

This article has several objectives: To review the common dichondra pests and their control, to discuss two new pests, and to present some of our personal observations and opinions on insecticides and pest control. It should be remembered that it is natural to find many insects and other small arthropods in dichondra. Only a few of these cause serious damage, some are beneficial, and others are pests only if they become too numerous. Since symptoms of injury from insects and other pests often are not clear cut and are easily confused with troubles caused by diseases and poor cultural conditions, the presence of injurious pests should be confirmed before insecticides are applied.

We believe that insecticides should be applied only when a pest is present in sufficient numbers to cause damage. Also with respect to pest control, we cannot overemphasize the importance of proper fertilization and good cultural practices. Healthy, vigorous dichondra will outgrow the effects of many infestations. However, when it is in poor condition, damage may be more severe and recovery following insecticide treatment is slower.

CUTWORMS

Cutworms are rather fat-bodied caterpillars ranging in length from 1 to 2 inches when fully grown (Fig. 1). They are usually dull-colored, greenish, gray, brown or blackish, and often with spots or longitudinal stripes. They feed on the leaves and



Fig. 1. The armyworm, *Pseudaletia unipuncta* (Haw.)

¹Professor of Entomology and Extension Entomologist, respectively, University of California, Riverside.

crown, and may cut off young plants at the ground level. While an established lawn may support quite a population of cutworms without showing much damage, new dichondra may be severely damaged. Cutworms usually feed at night and hide during the day in holes, under debris, or beneath the mat of organic matter at the surface of the soil. The adults are mostly dull or somber-colored moths. Only the caterpillars are injurious.

Injury is most likely to occur during the summer and early fall months, and has been most severe in the warm inland areas. Probably the greatest difficulty in controlling cutworms is in recognizing a serious infestation before the lawn is badly damaged. A lawn may support many small cutworms without showing much damage. However, as the caterpillars approach full size, the amount of food they consume increases enormously, and the lawn may be injured seriously in a period of 2 or 3 days. Also the large caterpillars are more difficult to kill with insecticides than the small ones.

To prevent cutworm damage, a close check of the lawn should be kept during the summer and early fall. For vigorous, well-established dichondra it is not necessary to apply an insecticide unless there are more than 2 or 3 cutworms per square yard. Young dichondra, especially at the seedling stage, is much more susceptible to damage and should be treated if more than an occasional cutworm is found. From the standpoint of cutworm damage, new lawns should be seeded before May or after September. This avoids having the dichondra in its most susceptible stage during the peak of cutworm activity.

To determine if cutworms are present, sections of the lawn can be flooded at night, or the pyrethrum test can be used. In the latter, mix one tablespoon of a commercial pyrethrum preparation (containing 0.5 to 1 per cent pyrethrins) in a gallon of water, stir thoroughly and apply with a sprinkling can at the rate of one gallon of the mixture per square yard. Pyrethrum irritates the caterpillars and brings them to the surface. Several areas in the lawn should be tested. If the lawn already shows signs of damage, the mixture should be applied to green areas in and around the damaged sections.

Control of cutworms. DDT and toxaphene are effective against cutworms. Preparations designed especially for cutworms in turf and dichondra and containing one or both of these materials are available. The new carbamate insecticide, Zectran[®], is very effective against cutworms and is preferred by us. All of these materials should be applied according to the manufacturer's directions. Zectran is sold under the name of Dow "Snail, Slug 'N Bug Killer" and when applied as directed for slugs (see below) will also reduce populations of snails, springtails, millipedes, sowbugs and pillbugs.

FLEA BEETLES

Flea beetles (Coleoptera: Chrysomelidae) are a new pest of dichondra and were first brought to our attention in 1962 by Mr. Gene Harper of the Agricultural Commissioner's Office of San Bernardino County. The species has been identified as *Chaetocnema magnipunctata* Gentner. In San Bernardino County infestations have been found in the city of San Bernardino, Loma Linda, Redlands, Fontana and Highland. In 1963 a number of dichondra lawns in the City of Riverside were severely damaged. We have also had reports of damage in Los Angeles County.

The adult flea beetles (Fig. 2) are black and very small, about 1 mm (1/25 of an inch) long. They feed on the upper surfaces and skeletonize the dichondra leaves. When enough of the leaf is eaten away the leaf turns brown. The injury (Fig. 3) is very characteristic and can readily be seen with an ordinary magnifying or reading glass. The damage



Fig 2. Flea beetles, *Chaetocnema magnipunctata* Gentner.

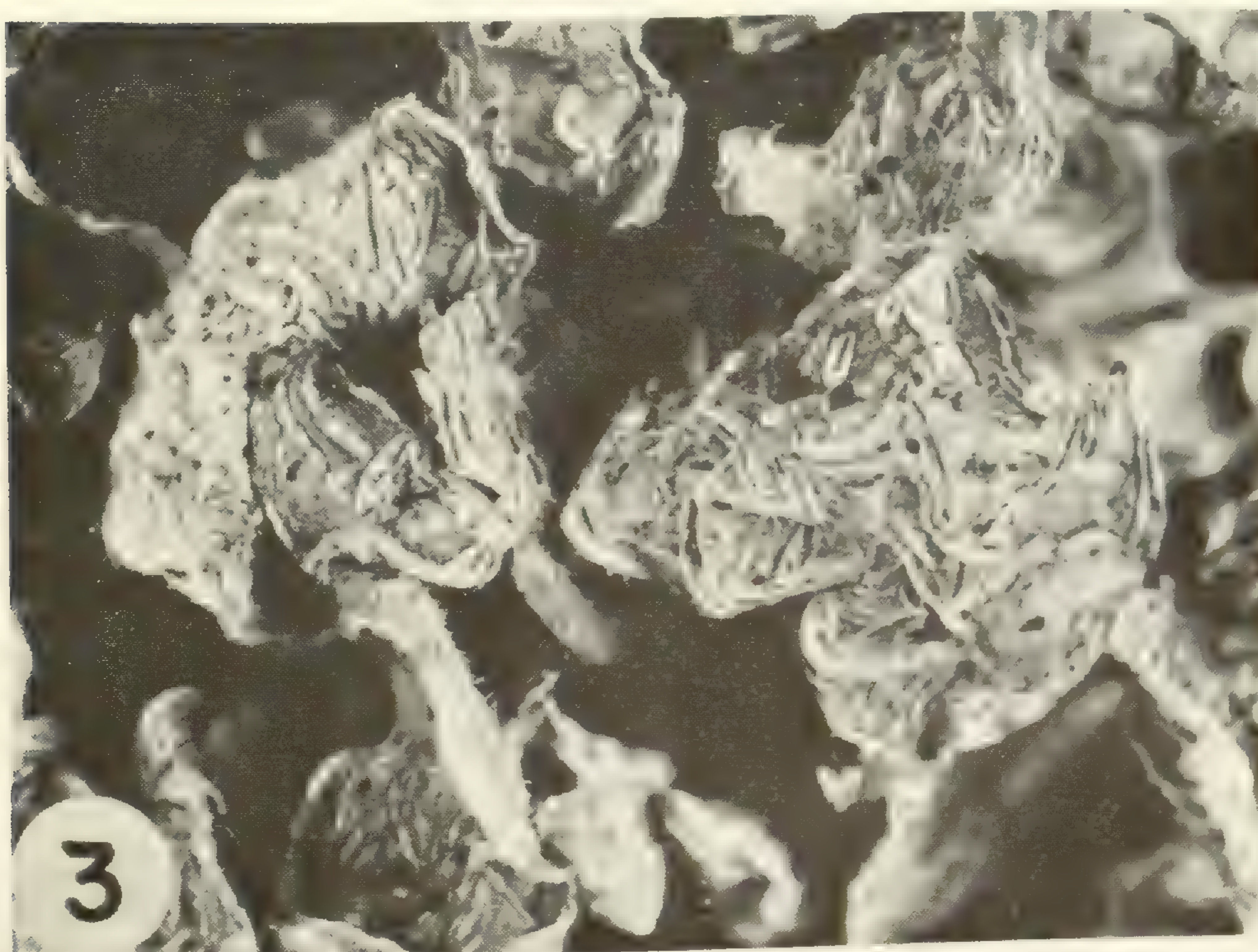


Fig. 3. Two dichondra leaves (enlarged) showing flea beetle damage.

at first appears to be localized or spotty and since the beetles are so small most people assume the damage is due to lack of water or fertilizer burn. Usually it is not until the lawn is severely damaged that they suspect or associate the damage with an insect.

Very little is known about the life cycles of most flea beetles. With dichondra it appears that damage is most likely to occur during the warm months—from May through October. Observations on one lawn in Riverside indicate that in the summer a generation may be completed in approximately a month. The grubs (larvae) probably develop in the soil and feed on the roots. However, significant damage has not been observed until the adults emerge and begin feeding on the leaves.

Control of flea beetles. Spray the lawn with DDT or one of the preparations containing DDT and designed for cutworms. Apply at the rate given on the label for cutworms and use enough spray to thoroughly wet foliage and the surface of the ground.

LUCERNE MOTH

This is another new pest of dichondra and damage to lawns has been reported during the last several years in the San Gabriel, Monrovia, Arcadia area. While clover and other legumes are preferred, the larvae will feed on dichondra and grasses. The larvae are slender, spotted caterpillars very similar in appearance to lawn moth larvae but a little larger, the full grown caterpillars being about an inch long. While lawn moth larvae are relatively sluggish, lucerne moth larvae wriggle actively when disturbed. The adults have a wing spread of an inch or slightly more. The hind wings are gray and the forewings are mottled gray brown with two pairs of indistinct dark spots. Damage to dichondra has occurred mainly in the summer and early fall months.

Control of the lucerne moth. DDT and Sevin do not appear to be very effective against lucerne moth larvae. Since we have not had an opportunity to do any experimental work with this pest we can only make a suggestion as to control. Zectran is suggested as the material most likely to control this pest. Use it at the rate of 3 pints of the emulsion per 100 gallons of water (1 tablespoon per gallon). At lower rates it has been reported to be ineffective.

VEGETABLE WEEVIL

In recent years the vegetable weevil has become a pest of increasing importance in dichondra in southern California. Damage is most likely to occur during the winter and early spring months, and probably is accentuated by the fact that growth of dichondra is slow during this period. With heavy infestations, damage is severe and recovery is slow.

Grubs of the vegetable weevil (Fig. 4) are small, green, legless larvae about $\frac{3}{8}$ of an inch long. They hide in the soil during the day and feed on the foliage at night. The adult weevils (Fig. 5) cannot fly so infestations are usually localized.

To prevent damage from the vegetable weevil, frequent examinations of the lawn are necessary during the winter and early spring. The grubs and adult beetles are most easily found at night when they are feeding. If more than an occasional grub or beetle is found the lawn should be treated.

Control of the vegetable weevil. Malathion, dieldrin or Zectran sprays are effective against the vegetable weevil. If specific directions for the vegetable weevil are not given on the label, use malathion at the rate given for mealybugs and scale insects, dieldrin at the rate given for thrips and weevils and Zectran at the rate given for snails and slugs. Apply enough of the spray to thoroughly wet the plants and the surface of the soil.



Fig. 4. Grubs (larvae) below, and pupa above, of vegetable weevil.



Fig. 5. The vegetable weevil, *Listroderes costirostris obliauus* (Kluge)

MITES

Damage to dichondra lawns may result from infestations of the two-spotted spider mite or closely related species. These mites (Fig. 6) are about $1/50$ of an inch long, globular in shape, and reddish, yellowish or greenish in color. They feed by sucking the plant juices, the first symptom of injury being a speckling of the leaves. This is followed by a yellowing or bronzing effect and the drying up of the leaves. The mites spin fine webs and with large populations the plants may be heavily webbed with large masses of mites in the webs.



Fig. 6. Spider mites, *Tetranychus* sp.

Other mites may be associated with dichondra but normally are not injurious.

The oxalis mite is a bright red color and is approximately the size of the two-spotted spider mite but with longer legs. It feeds only on oxalis, causing a yellowing or bleaching of the leaves which makes the oxalis more noticeable. The clover mite feeds on clover, grasses, weeds and various other plants and shrubs. It differs somewhat in appearance and habits from other spider mites. The adults are about $1/30$ of an inch in length with long front legs. The legs are amber or orange-colored and the body may vary from reddish-brown to a greenish color. The clover mites may invade homes when large populations build up in adjacent areas.

Control of mites. Spider mites damaging dichondra can be controlled with Kelthane or Dimite sprays applied according to the manufacturer's directions. It is important that the applications be thorough and that the undersides of the leaves be wet by the spray. For effective control, at least two applications about two weeks apart are required. Control of the clover mite by home owners is difficult and it is recommended that a commercial pest control operator be hired.

DICHONDRA PESTS

SLUGS AND SNAILS

These are common pests of dichondra lawns. Control is difficult since there usually is a continuous migration of these pests from other areas. The common brown garden snail can be controlled with baits containing metaldehyde. Baits are less effective against slugs. Both snails and slugs can be controlled with Zectran sprays but repeated applications are necessary. Use Zectran (Dow Snail, Slug 'N Bug Killer) at the rate given on the label. Areas where slugs and snails tend to congregate should be thoroughly drenched with the spray.

MISCELLANEOUS PESTS

Ants may invade homes or cause unsightly mounds in lawns. They can be controlled with chlordane, dieldrin or diazinon (Spectracide) applied according to the manufacturer's directions. Earwigs, springtails, millipedes, sowbugs and pillbugs are common-inhabitants of lawns. They are pests only when they become very numerous since their normal food is decaying organic matter. When necessary they can be controlled with sprays of diazinon, malathion or Zectran. Gnats and small flies may also breed in dichondra lawns. The adults may be a nuisance in patios and yards, and may enter homes. The larvae or maggots feed on decaying organic matter. Spraying the dichondra with diazinon or malathion may give relief.

The use of organic fertilizers—blood meal, fish, activated sludge and similar products are conducive to the buildup of large populations of earwigs, springtails, millipedes, sowbugs and pillbugs. They also attract gnats and provide more favorable breeding conditions.

APPLICATION OF INSECTICIDES

Do not apply insecticides to dichondra needing water. Make a light application of fertilizer, if needed, and water well before treatment. Apply the insecticide when the foliage is dry and do not water again until necessary. Use enough spray to thoroughly wet the foliage and the surface of the ground. Do not spray when the temperature is above 90°F.

Caution! All insecticides are poisonous. Carefully follow the precautions on the label. Do not allow children or pets to play on treated lawns for 5 days. Keep insecticides in their original containers and out of reach of children, irresponsible persons and pets.

Note: The photographs in this article are not according to scale. See text for approximate size of the pests.



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COVER PICTURE

On the cover of this issue of Lasca Leaves is a color picture of one of the Arboretum's outstanding introductions. A ground cover, trailing African daisy, well-adapted to our climate comes to us from Cape Province, Union of South Africa, where many of our best garden plants originated. Its story is told in a separate leaflet that can be taken out and tacked up on your potting shed wall for easy reference.

IN THIS ISSUE

Our first article is a real scoop—the first report by anyone of a practical way to prevent smog damage. Everyone talks about smog and, to paraphrase an old cliché about the weather, now Wilfred M. Noble has done something about it. We are proud that this was accomplished in cooperation with the Arboretum. Mr. Noble was born in Brooklyn. He was graduated from the University of Redlands and earned his M.S. degree at USC. He was associated with Los Angeles County Air Pollution Control from 1948 until 1964 when he was retired. Currently he is with the United States Department of Health, Education and Welfare at the Arboretum studying the affect of air pollutants on plants.

Glenn Hiatt, who tells of his plant collecting trip to Costa Rica and Colombia is, in the absence of Dr. William Stewart, acting head of the Arboretum. A native of Pasadena, he was graduated from USC and from 1941 to 1945 was Research Assistant in Plant Physiology at Cal Tech. He is well-known in the industry for, from 1945 to 1957 he was a plant grower, the owner and operator of Orchid Research. In 1957 he joined the staff of the Arboretum and in 1962 was made Assistant Director.

The Editor contributes a timely article on Oriental magnolia, plants prized for landscaping.

Included in the back of the index for Vol. IX is a Calendar of Events for 1964-1965. More complete information is available before each event. We ask you to check these dates in your social calendar.

A simple index to many of our most damaging insects is contributed by J. Alex Munro, Arboretum entomologist. Dr. Munro was born in Ontario, Canada, and graduated from Ontario Agricultural College. He was granted his M.S. degree at Kansas State and his doctorate at Cornell University. From 1926 until 1961 he was Head of the Department of Entomology of North Dakota Agricultural College. Since his retirement he has been associated with the Arboretum as entomologist.

Last, but not least in this miscellaneous issue, is a progress report on the Arboretum's hibiscus project by Ross H. Gast. This interesting report will be followed in the near future by an entire issue devoted to the breeding, history and culture of hibiscus. Mr. Gast was born on the corner of Compton and Slauson in Los Angeles and soon moved to Vernon where his father was a market gardener. As the developer of Twistems, he has been associated with Germain's for more than 20 years. From 1922 until 1935 he was on the staff of the Los Angeles Times, writing for the precursor of the Home Magazine, then called "Farm and Garden". At present he is a consultant in agricultural merchandising and Research Fellow at the Arboretum.

Finally, to keep us up to date on garden literature are three book reviews. Mira Culin Saunders who reviews the joint publication by the Arboretum Foundation, Los Angeles Beautiful and the Horticulture Institute, entitled "Flowering Trees for Year 'round Color in California, is the widow of the pioneer California garden writer, Charles Francis Saunders.

The second review by George Spaulding, calls our attention to a new book, "Let's Grow Lilies!" Our readers will enjoy this publication, not only for the excellent information on lilies, but also for the author's drawings which appear in the margins of each page depicting the lily grower's good and bad moments as he demonstrates the "dos" and "don'ts" of lily growing.

Reviewed by the Editor is a new booklet from the Santa Barbara Botanic Garden by Dara Emery on "Seed Propagation of Native Plants."

The Editor

The Reduction of Oxidants by Gum Guaiac

WILFRED M. NOBLE

The effects on vegetation of oxidants in general and of ozone in particular have been observed and reported by many authors (3, 5, 6). A few studies have been reported on sprays or dusts which might alleviate the effects of these gases (1, 4). Before terminating his work with the California Arboretum Foundation, Arthur Lanz suggested that gum guaiac showed considerable promise as a protectant against oxidant type injury to vegetation.

In order to determine the efficacy of this material a number of experiments were performed. In these, ozone and also the ambient atmospheric smog were used. Oxidants or ozone alone were measured by the phenolphthalin method of Haagen-Smit and Fox (2). The gum, which is insoluble in water was used in several different forms; as a powder in water, as a suspension in water prepared from an alcoholic solution, and as a dry powder.

Suspensions, both as powder added directly to water and as colloidal suspension from alcoholic solution added to water were placed in gas washing bottles with fritted glass cylinders or discs. These bottles contained 75 ml. of suspension and this volume was maintained by frequent additions of deionized water. When the dry powder was used it was placed in a vertical drying tube stoppered loosely at both ends with cotton and the powdered gum maintained in a fluid state by the air flow. An alcoholic solution was also added to the water reservoir of a recirculating evaporative cooler and oxidant measured before and immediately after the addition. When the gas wash bottles were employed, two blanks were used; one, a direct measure of the oxidant, and the other, using a gas washing bottle containing water and an amount of alcohol equal to that used to disperse the gum. Air flow rates through the gas wash bottles were normally around a liter per minute, although higher rates were occasionally employed. However, higher rates usually resulted in excessive foaming.

In one experiment, between May 14 and June 5, 1964, ozone at a concentration averaging above one part per million was bubbled through a suspension of 1.5 gm. gum guaiac in water for 153 hours. The average ozone removal for the first 15 hours was 80% and for the first 100 hours, 87%. At the termination of the experiment, the gum was still removing 63% ozone at 1.60 ppm and 69% ozone at 0.80 ppm.

In another experiment which ran for 365 hours, the ozone concentration averaged 1.5 ppm. The gum guaiac was a suspension of 1.0 gram in 75 ml. of water prepared from an alcoholic solution. Initially 100% of the ozone was removed. At the end of 200 hours, 75% of the ozone was being removed at a concentration of over 2.0 ppm. At the end of 365 hours, 75% of the ozone was being removed at a concentration of 2.34 ppm. and 89% at a concentration of 1.35 ppm.

In a third experiment, using the ambient atmospheric smog, 0.012 gram of gum guaiac was used as before and run for 3 successive days, the total elapsed time being 15 hours. During this period, the measured oxidant concentration varied from 0.04 ppm to 0.25 ppm. At 0.10 ppm the gum removed 100% of the oxidant while between 0.22 ppm and 0.25 ppm it removed 90%.

When the gum was used as a dry powder, the efficiency was good initially, but dropped to 30% within 24 hours. This would be expected, since the particles of powder would probably react only on the surface.

The addition of 10 grams of gum dissolved in alcohol to the reservoir of a recirculating evaporative cooler produced no observable effect, nor did the addition of 50 grams as a powder. When, however, 50 grams was added from an alcoholic solution, the concentration of oxidant passing through the cooler was reduced from 0.16 ppm to 0.11 ppm and after one hour the concentration coming through was 0.12 ppm while that of the outside (inlet) air was 0.19 ppm.

It is apparent that gum guaiac will remove ozone and ambient oxidant from the atmosphere. However, additional studies are being made to determine both its efficiency and its ability to protect vegetation by direct application.

The possibility of protecting animal tissues by this material is being considered. Physical characteristics of the gum itself, however, present difficulties in this respect.

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Plant Collecting Expedition to Central and South America

by GLENN HIATT

The Arboretum will never look like the Central or South American tropics, but the introduction into Southern California of some of the magnificent trees, shrubs, and herbaceous plants from this part of the world will certainly enhance our landscape. There is an abundance of species, especially those growing at high altitudes near the equator, that should acclimate easily to our environment.

You recall the collecting trip to Costa Rica in 1960, by the writer, with Clarence Horich as guide, when an extensive search into remote areas produced seed and plants not heretofore growing at the Arboretum. This also justified our primary interest in augmenting the orchid collection from this rich collecting area.

A letter from Clarence Horich of January 6, 1964, expressed great concern over the Irazu volcano destroying the vegetation and the economy of Costa Rica. This is one of a series of volcanoes originally responsible for the unique environment creating the wealth of plant life. It is believed that the Cordilleras, a mountain range extending longitudinally through Costa Rica, and the rest of Central America, first was formed by volcanic eruptions millions of years ago.

Irazu, 11,260 feet elevation, 17 miles northeast of the capitol city of San Jose, crowns one of the richest plant areas in the world. Even in similar areas the intricate topography characteristic of this country is responsible for a great diversity of entirely different plant groups. Virtually every creek, gulch, or river, even those in the same locality, has a different partly endemic flora.

En route to Colombia for a plant collecting expedition in the spring of 1964, in direct response to a plea from Mr. Horich to collect botanicals and other exotic flora that were still alive in the forest, it was decided to again visit Costa Rica, see first hand the damage to plants. The enthusiastic response of the many members of California Garden Clubs, Inc., and the California Arboretum Foundation, Inc. to sponsor this trip was most gratifying.



The basic purposes of the expedition were to collect seeds and plants of ornamental trees and shrubs for possible future plant introduction; to gather orchids, bromeliads, and other tropicals to augment the Arboretum collection, and to define habitats of the above plants and study the intricate topography and microclimates found in the mountain ranges. To this end, plants were sent every few days to the Arboretum. To date, 285 different species of plants have been shipped. Seeds of ornamental trees and shrubs, as well as cuttings, are still being collected and shipped, when they are ripe for harvesting, by the contacts made in the area.

Costa Rica averages 100 miles in width and 200 miles in length, with elevations from sea level to 12,800 feet. One-third of the entire country was formed by mountains of volcanic origin. It can be segregated into several defined habitat areas; Atlantic cloud forest, Atlantic rain forest, intermediate areas between Pacific and Atlantic watersheds, isolated cloud forests with endemics, Pacific humid jungle, Pacific xerophyte vegetation, and high paramo. The high mountains of Costa Rica are arranged in two great chains running almost parallel and extending the length of Central America. These mountains govern the distribution of the rainfall. They form an effective barrier against the rain-clouds driving in from the Caribbean holding them at the summits, but the irregularity of the terrain allows them to descend the drier Pacific slopes. It is in these areas that many of the epiphytes such as orchids, philodendrons, and other exotics are found.

Depending on elevation and rainfall, temperature and winds vary from the hot lowlands to the cold highlands. The intermediate zone near San Jose experiences an eternal spring. Dense rainforests characterize the entire Atlantic slopes, creating an expansive and almost impenetrable green forest, with an infinitely varied number of plant species. Because of the dense crowns of the tall trees intercepting most of the sunlight, there is an understory of small trees, which hosts hundreds of different epiphytes, varying in size from the smallest lichens to the largest aroids. Bromeliads, philodendrons, ferns, and orchids are also abundant in this environment. Perhaps the most exotic, but not necessarily the most important, plants collected for the Arboretum are orchids, for which Costa Rica is famous. As a plant family, orchids are more widely distributed in Costa Rica than any other genus. However, the diversity of plant and flower characteristics corresponds to the extraordinarily numerous microclimates induced by the unusual terrain. Even Costa Rica's official flower, *Cattleya skinnerii*, has a reasonably restricted distribution. Other orchids may be found only in small pockets of one or two acres in size and nowhere else in the world.

The expense of shipping plants from Central America to the United States, not to mention the time-absorbing red tape required to get them out of the country, is the limiting factor which restricts the number of plants that could be introduced. With the wealth of plants suitable for Southern California, it is frustrating not to be able to send them back by the carload.

Surely the Arboretum and Southern California should benefit from the introduction of new plants from comparable environments such as this. The writer, too, will benefit from having seen and studied these plants in their native habitat.

Oriental Magnolias

by ROBERT E. ATKINSON

The largest flowers of all the hardy flowering trees are found on the magnolias. This genus, native to America, China and Japan, is composed of evergreen and deciduous species. However, the Oriental species, which bloom in the spring before their leaves appear, are so spectacularly beautiful that gardeners and landscapers have used them in the most conspicuous spot as highlights of the garden.

Whatever your desire is in the height of a tree, you can find it in this group. Flowering magnolias vary from shrubs 10 feet high to small trees 15 to 20 feet and include some 80 to 100-foot giants that are almost too large for a small lot.



Starry Magnolia (*Magnolia stellata*)

Photo by Hort-Pix

Smallest of them all and earliest to bloom is a shrub known as starry magnolia. It forms its white flowers with long strap-like petals in February and March. Although the flowers are smaller than the other species, they are produced profusely and over a long period of time. This species is extremely hardy—also comes in a light pink and a dark pink, almost purple, varieties. This was introduced in 1862 from Japan.



Lily Magnolia (*Magnolia liliflora*)

Photo by Hort-Pix

Hardy south of Philadelphia is another small one, the lily magnolia, which flowers from April to early June. The species has large flowers about 4 inches across, purple outside and white inside. A variety called *nigra* is a very dark purple with pinkish tones inside the petals. Introduced into England in 1790, it had been grown in Chinese gardens for centuries.

The Yulan magnolia is a tall tree that frequently attains 35 feet. It, too, has been grown since the T'ang Dynasty and large specimens are found in temple grounds and gardens all over China. The white flowers are symbolic of purity and a favorite subject for paintings, ceramics and embroideries well-loved by artists for generations.



Yulan Magnolia (*Magnolia denudata*)

Photo by Hort-Pix

It was introduced into England in 1779 and a variety with rosy pink flowers was introduced in 1900 by Ernest H. Wilson, the well-known plant explorer. The chalice-shaped, sweetly fragrant blooms are numerous on bare, gray branches and a mature tree in bloom is a never-to-be-forgotten spectacle. Flowers appear in February and March in mild areas and in late April and May in the colder sections where Yulan is extremely hardy.



Saucer Magnolia (*Magnolia soulageana*)

Photo by Hort-Pix

Best known of all, the saucer magnolia, *M. soulageana*, is a hybrid between Yulan and the lily magnolia first grown in 1820 by Etienne Soulange Bodin, an officer of Napoleon's Army. This small tree rarely reaches 20 feet in height. Pink blossoms tinged with purple appear as early as February but mostly in March and April.

Many varieties exist and some are superior, such as *lennei*, which originated in Italy. It has the largest flowers of any saucer magnolia, colored rosy purple outside and white inside. It blooms late and flowers are rarely damaged by frost. Last to bloom is *brozzonii*, featuring tremendous 5-inch white flowers with a purple blush at the base. Many consider this to be the finest variety.

The queen of the Oriental species is undoubtedly Campbell's magnolia, which is the least hardy species. This is the star attraction at botanical gardens and arboreta when it blooms, usually very early in the spring. Discovered over 100 years ago, it is not well known nor widely distributed. The reasons: it takes 20 years to come into bloom, it is a large tree—40 to 50 feet high—suited best to the larger gardens, and the supply is limited.

M. campbelli has cup-shaped flowers 7 or 8 inches across, of a pearly pink color with great fragrance. They are held upright and petals do not fall apart as in most other species, instead the flower keeps its shape and freshness for a full week after the buds open.

Top challenger for honors is a hybrid between the Campbell and the Yulan magnolias, named Vietch. Ivory white flowers with a coral blush are every bit as large as *campbelli*. Blossoms have a richer fragrance and appear later, escaping late frosts. It grows rapidly and blooms early in life, usually in its fifth year. It grows to 40 feet but is slimmer and more upright and it fits better into a small garden.

Osteospermum fruticosum

ARBORETUM INTRODUCTION — 1958

Common Name	: Trailing African Daisy
Generic Name	: <i>Osteospermum fruticosum</i> , Supp XI Kew. 173, (L) Norlindh.
Family	: Compositae
Origin	: Cape Province, South Africa
Form	: Evergreen ground cover
Flowers	: Lavender daisy, fading the second day. Blooms intermittently throughout year but heavy during winter (November to March).
Foliage	: Evergreen
Growth Rate	: Rapid—rooted cuttings or liners planted 2 feet apart will cover an area completely in a year or less, with a maximum of 6 inches high growth.
Soil Requirement	: Very tolerant of variety of soils but does best in sandy well drained loam.
Exposure	: Full sun.
Temperature Tolerance	: 28°F.
Water Needs	: Moderate—thorough soaking weekly during hot weather in light to medium soils.
Pruning	: Only needed to keep plant in bounds.
Propagation	: Seed or cuttings—cuttings may be started anytime of year but root most quickly if taken when plant is not in bloom.
Remarks	: This plant was known for many years as <i>Dimorphotheca fruticosa</i> and was originally obtained by the Arboretum under this name. It was later determined by the Arboretum Taxonomist to be <i>Osteospermum</i> . This trailing South African Daisy is excellent as a ground cover and for banks. It blooms during the winter months here in Southern California so is valuable for color during the time color is at a premium in gardens. So far it has not been troubled by any insects or diseases, although, in common with practically all plants, it may occasionally have aphids on new growth.



Osteospermum fruticosum (L.) T Norlindh. (*Dimorphotheca fruticosa* Less.)

Leaves simple, obovate, finely and remotely denticulate or sometimes entire, ciliate, rounded or obtuse and mucronulate at the apex, up to $\frac{3}{4}$ in. wide, (oblanceolate, dentate, with 4, 6 or 8 coarse marginal teeth and usually larger on vigorous shoots), tapering to a petiole, alternate, scaberulous above and beneath, somewhat glossly and fleshy.

Heads up to 2 in. across or larger, solitary, terminal, long-pedunculate. Involucral bracts uniseriate, linear-lanceolate, scaberulous. Ray-flowers numerous, purple, lighter above, darker beneath, becoming nearly white above, fertile. Disk-flowers numerous, dark purple, abortive.

Fruits (achenes) without pappus, drupe-like, slightly curved, trigonous, with bony seed.

A perennial almost herbaceous plant with long, trailing and rooting branches.

Insects and Plant Protection

J. ALEX MUNRO, *Entomologist*
(Illustrations by Gerry V. Patten)

Department of Arboreta and Botanic Gardens, County of Los Angeles

Protection of plants against insects and other pests is important to everybody. The grower is concerned with quality as well as quantity production and in meeting these goals must give special attention to pest control. The consumer's interests are also at stake because if fruits, vegetables, and other plant products are scarce or poor in quality because of pest injury, then higher prices for lower quality produce results.

The main object of this outline is to call attention to the more important pests and to indicate means of control. The use of pesticides is indicated in most cases.

In the use of pesticides, the operator must observe safety precautions in their handling, proper timing in their applications and the matter of pesticidal residues. Pesticides should not be applied to fruits and other edible plant products shortly before picking or harvesting. These and other matters are discussed more fully in pamphlets and other free publications from your COUNTY FARM ADVISOR, 808 North Spring Street, Los Angeles 12, California; telephone MADison 8-3383. Ask for the CATALOG OF AGRICULTURAL PUBLICATIONS; this will guide you in selecting the publications you may need.

GROUPS CAUSING PLANT INJURY

HABITS

EXAMPLES

Sucking insects	Aphids, mealybugs, scale insects, psyllids, whiteflies
Leaf eaters	Caterpillars, leaf-eating beetles and larvae
Girdlers	Oak twig girdler, bark and engraver beetles
Wood borers	Carpenter worms, round or flat-headed borers
Leaf miners	Larvae of various moths, beetles and flies
Gall makers	Cynipids, moth larvae, aphids
Soil Inhabiters	Cutworms, weevils, ants, various grubs
Misc.—not insects	Mites, sowbugs

IMPORTANT CONSIDERATIONS:

1. Know the insect or other pest which is causing the injury. If in doubt, regarding its identity, refer specimens to your County Farm Advisor for identification.
2. Carefully observe the manufacturer's directions or instructions on the label of insecticide or pesticides to be used. Store such chemicals preferably in a locked cabinet when not in use.
3. Keep in mind that, in addition to chemicals for control, there are other aids in controlling pests, including clean cultivation and natural control agencies.

The illustrations and descriptive material on the following pages will aid in recognizing some of the more important pests and what to use to control them.



ANTS: They invade homes in search of sweets, or visit plants to collect the honeydew deposit of aphids. Some make ant-hills on lawns; others construct nests in wood and thereby weaken wooden structures. Control with chlordane or dieldrin.



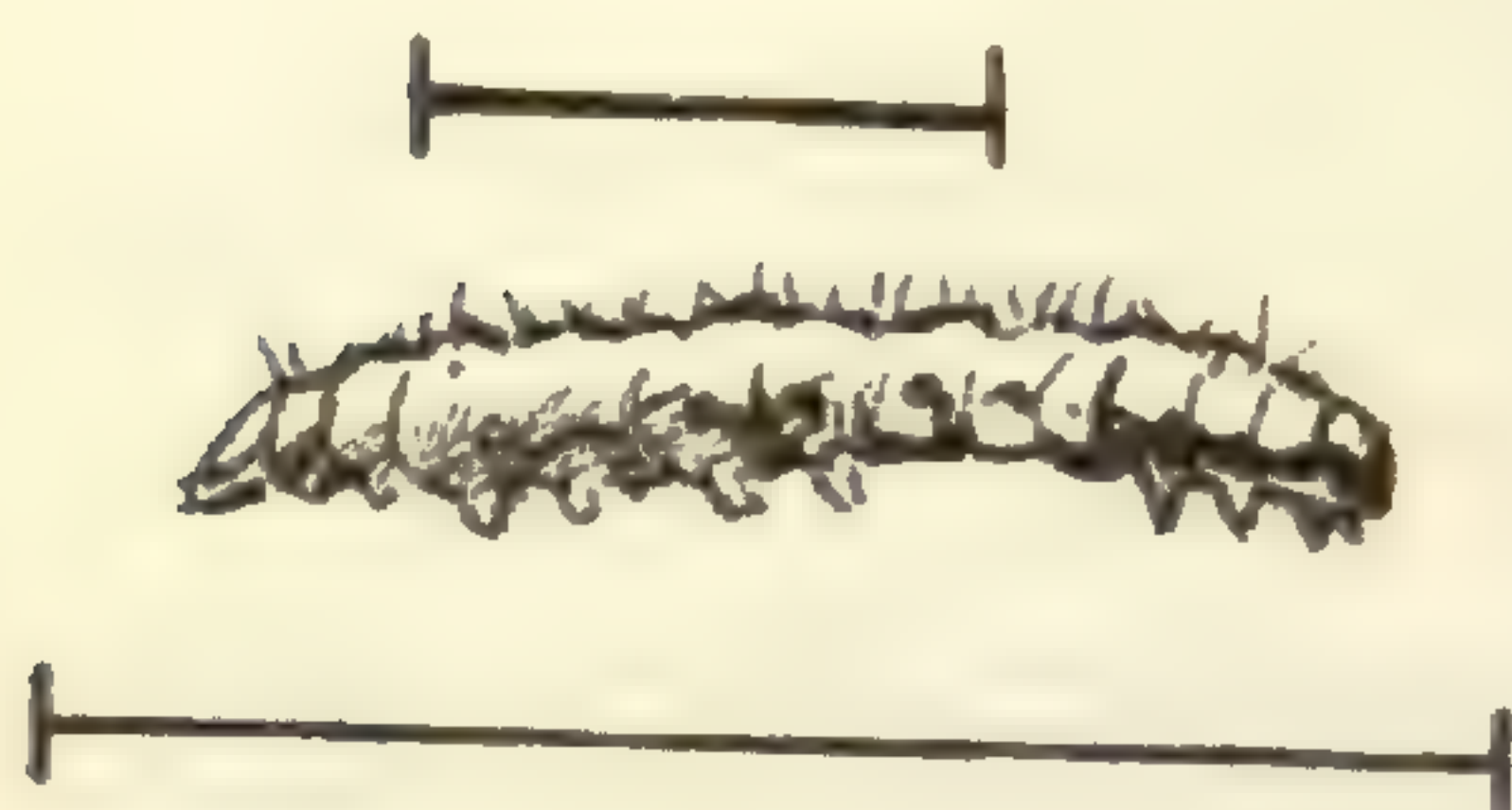
APHIDS: These small, soft bodied, sucking insects reduce the vitality of plants and spoil their appearance by depositing honeydew on the foliage; this favors development of sooty mold. Control aphids by spraying with malathion, lindane, or dimethoate; remove honeydew the following day with water from garden hose.



ASPARAGUS BEETLE: They feed mainly on the tender asparagus tips and cause them to become scarred and browned. The tips may be protected by spraying or dusting with rotenone or malathion.



BOXELDER BUGS: They suck the sap mainly from boxelder trees, especially the flower buds and developing seeds; often a nuisance in homes where they may feed on house plants. Control with household sprays containing dieldrin.



CABBAGE WORM: The larvae are especially injurious to cabbage and cauliflower plants. The parent butterflies visit these plants only to lay eggs. Control with malathion or dibrom sprays.



CANKERWORMS: Two main species, the spring cankerworm and the fall cankerworm. The female moths are wingless. Banding with tangle-foot traps the moths as they climb the tree to lay eggs; if banding is neglected then it may be necessary to spray the foliage with DDT to kill the worms.



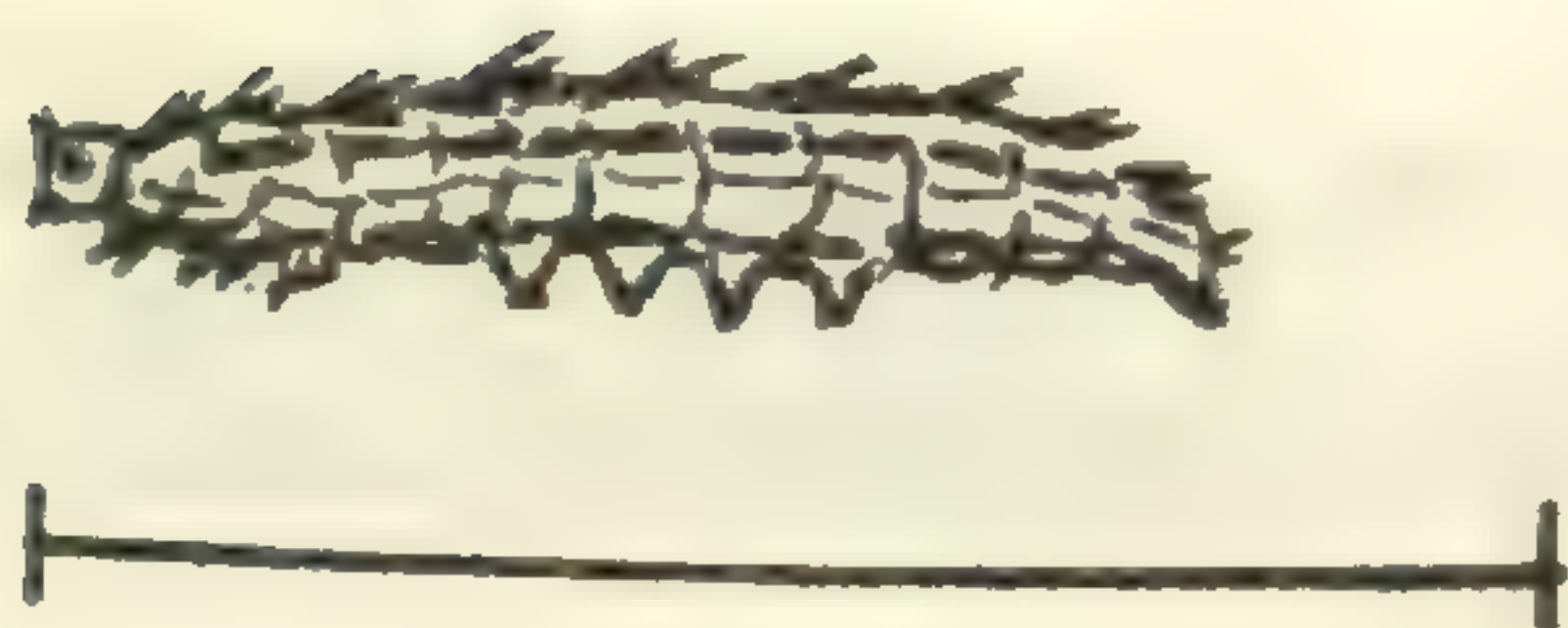
THE CODLING MOTH: This is the main cause of wormy apples, pears, and walnuts. DDT is used effectively in control. Consult your County Farm Advisor for detailed information as applying to your area.



THE CORN EARWORM: This pest is also known as the tomato fruit worm, cotton bollworm and tobacco budworm, depending upon the crop receiving injury. Controlled in sweet corn by the application of one-percent DDT, in mineral oil, into developing ears of corn.



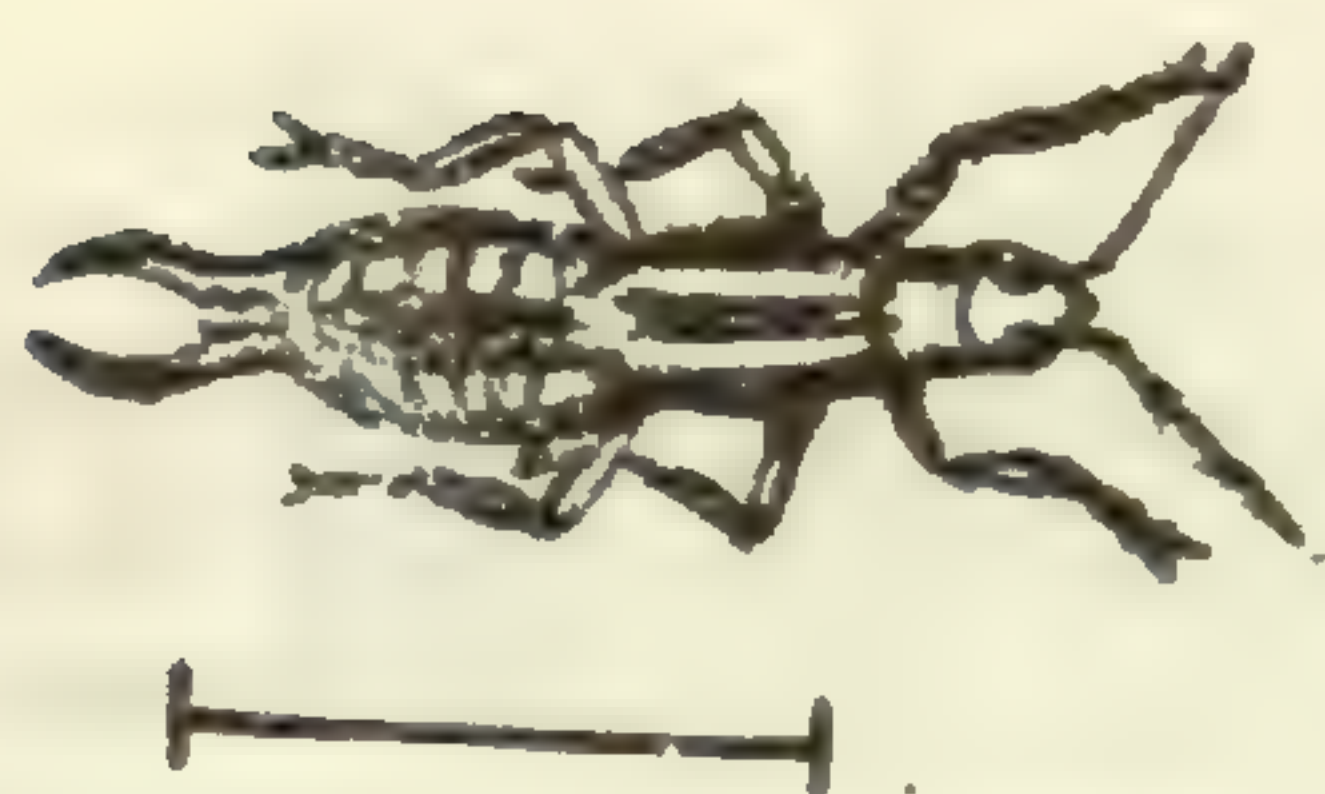
STRIPED CUCUMBER BEETLE: The beetles and their larvae feed mainly on cucumbers, muskmelons, pumpkins, squash, and watermelons. Timely applications of methoxychlor, malathion or rotenone will control this pest.



CUTWORMS: So named because they are especially prone to cutting off young plants at the base. They are destructive in lawns, gardens, and field crops. Control with DDT, toxaphene or zectran.



SPOTTED CUCUMBER BEETLE: Injurious to cucumbers, melons, beans, and corn; so injurious to the latter that this pest is referred to as the Southern corn root-worm in corn growing states. Soil treatment with aldrin or heptachlor kills the larvae.

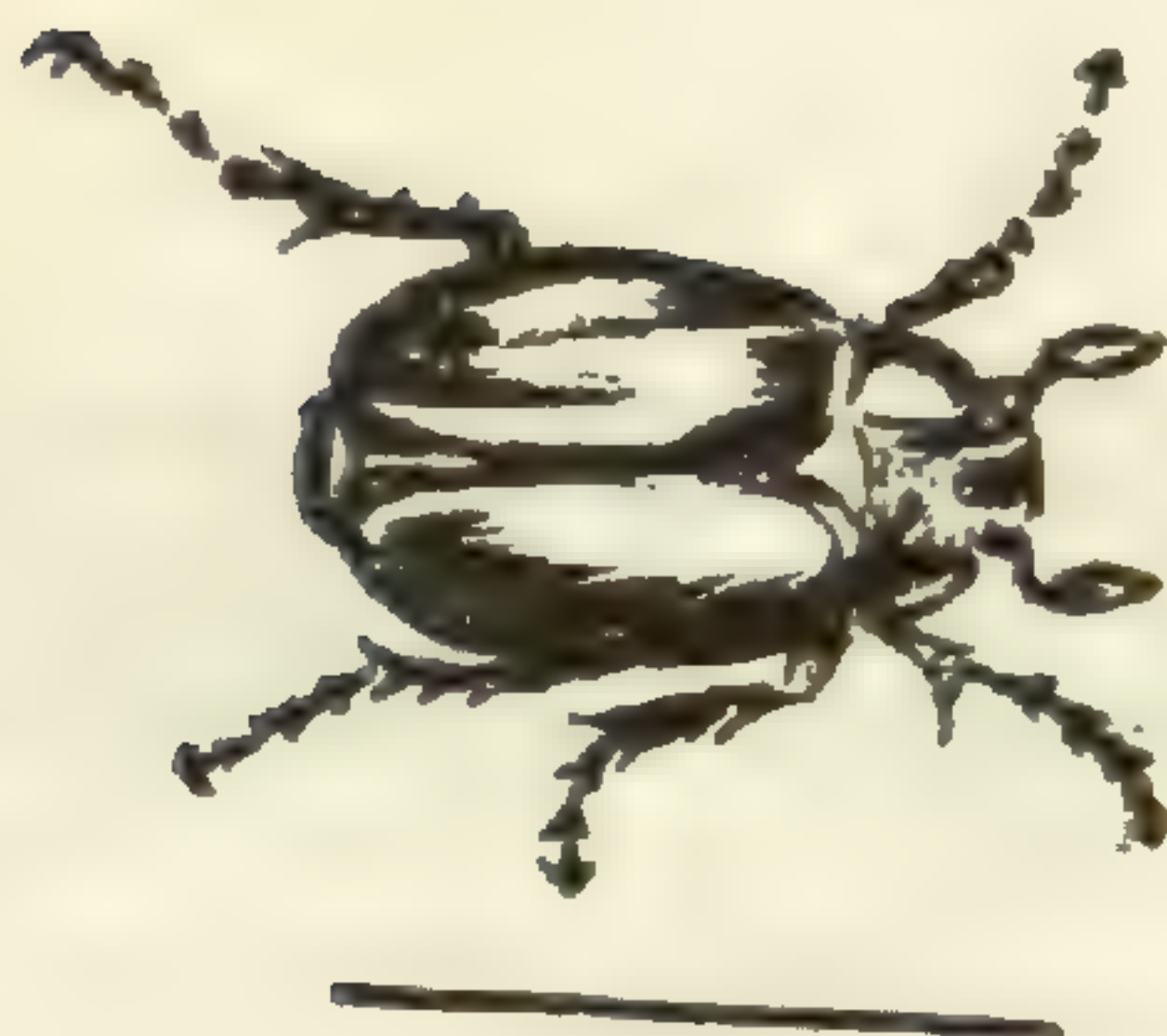


EARWIG: These dark colored insects feed at night and hide under bark and stones in daytime; occasionally injurious to fruits and ornamentals, and a nuisance in homes. Controlled with poisoned bran bait scattered around the house.

LASCA LEAVES



FLEA BEETLE: So named because the adults move rapidly by jumping. They eat small holes in the leaves of potato, corn, tobacco, cabbage, grapes and various other plants. Controlled by DDT spray.



JUNE BEETLE: These greenish, medium to large beetles feed mainly on ripening fruits; whereas their larvae feed on the roots of grass and other plants. Spraying with lindane, aldrin or heptachlor kills the adults; soil treatment using the same materials kills the grubs.



LAWN MOTH: Parent moths of the sod webworms. Control the larvae by timely application of aldrin, heptachlor or dieldrin. Cut the lawn and water it thoroughly before applying the insecticide.



DAMAGED
OAK LEAF

LEAF MINERS: Leaf miners are the cause of serpentine to blotch-like areas eaten between the leaf surfaces. Dimethoate, a systemic insecticide, is highly effective in controlling many kinds of leaf miners.



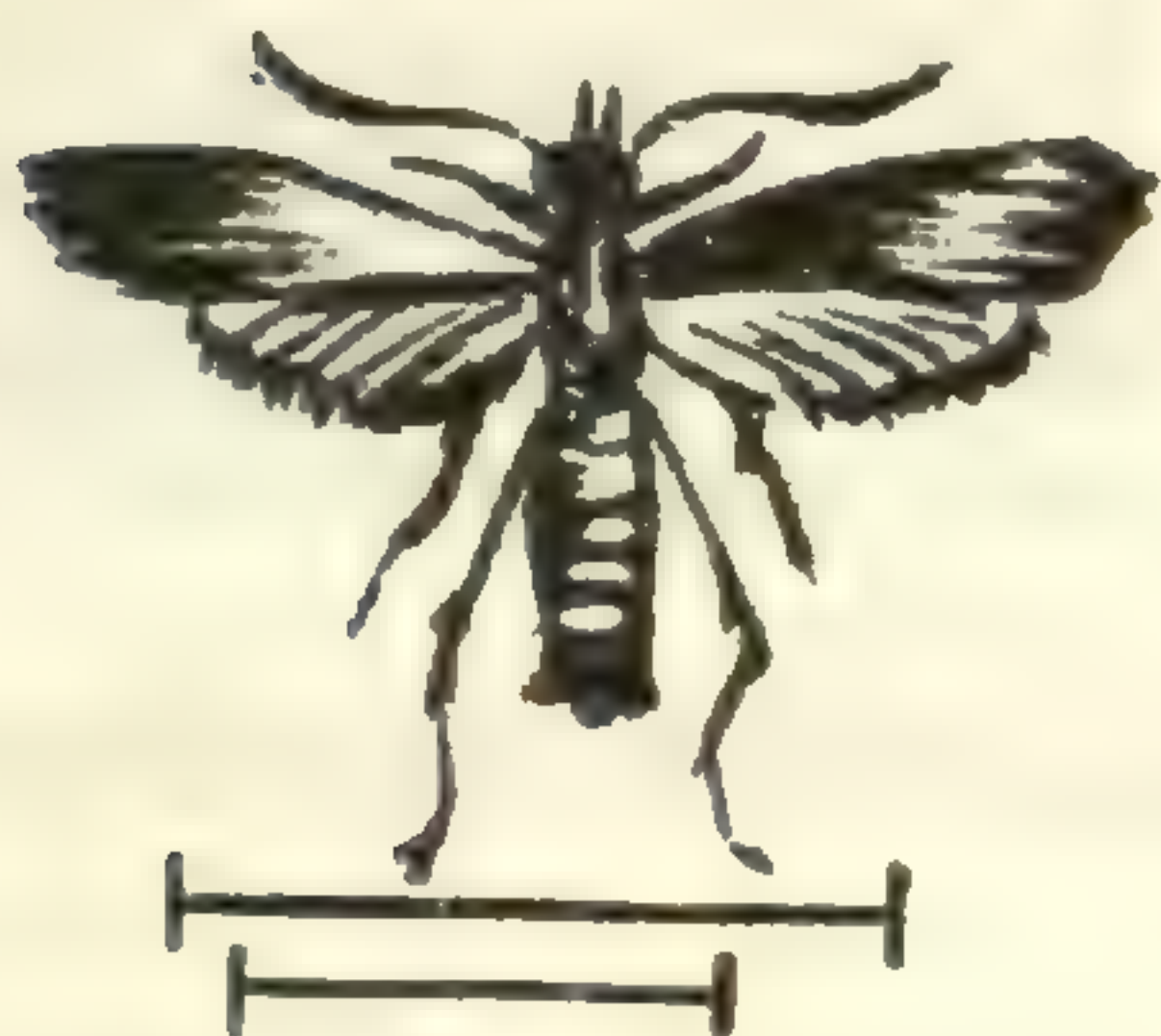
LEAF ROLLER: The larvae feed mainly on the leaves, causing the edges to roll upwards and inward, hence the name leaf roller. Prompt application of DDT, malathion or sevin controls them.



MEALYBUGS: These whitish, slow moving, sapsucking insects have a damaging effect on plants; they also deposit honeydew on the foliage. Controlled by the application of malathion, dimethoate or diazinon spray.



MELON OR PICKLE WORM: The moths lay their eggs on cantaloupe, cucumber and squash plants. The larvae burrow into the underside of the fruits. Control with malathion sprays or dusts; also observe proper disposal of the infested fruits.



PEACH TREE BORER: Injurious to peach, apricot, and plum. The larvae feed under the bark at the base and often cause serious damage before their presence is detected. A tablespoonful of paradichlorobenzene (moth crystals) applied around the base of the tree and mounded with earth, in the fall, kills the borers.



PSYLLIDS: These tiny insects suck the sap from acacias, pears, potatoes, and various other plants. Besides stunting growth of the host plants, they deposit a sticky honeydew on the foliage. Control with malathion, sevin, diazinon or dimethoate spray.



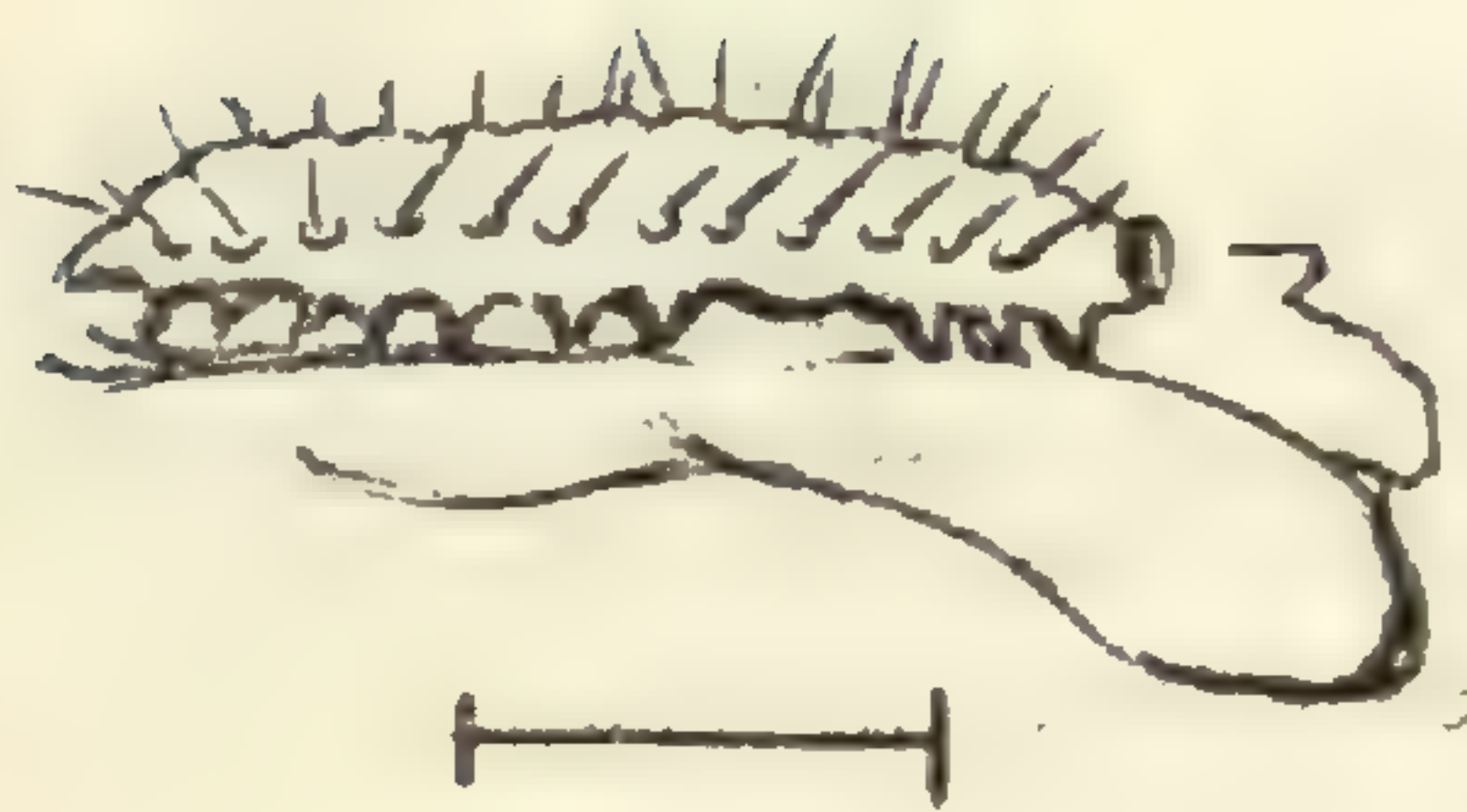
RED SPIDER MITE: These tiny creatures, not insects, are so small as to appear like moving dust particles on the underside of the leaves. They cause the foliage to become yellowed. Control by spraying with kelthane, malathion or aramite.



ROSE CHAFER: Injurious to roses, grapes and some others. The adults feed on the foliage, fruits, and flowers; whereas, the larvae feed mainly on the roots of plants. Control includes spraying the foliage with DDT; also, clean cultivation.



ROSE LEAFHOPPER: These small, rather active, sapsucking insects cause injury to rose shrubs as well as various other types of vegetation. Some species inject a toxic substance with the result that leaf tips become blackened; this is "hopperburn." Control with DDT spray.



ROSE SLUG: These greenish larvae cause injury by eating the upper surface, or epidermis of the leaves. This causes the injured leaves to turn brown and die. Dust or spray with DDT or malathion at the first indication of injury.



ROSE CURCULIO: These insects feed on all kinds of wild and cultivated roses by drilling small holes into the buds for feeding and egg-laying. Spray or dust the foliage with DDT dust or spray to kill these beetles.



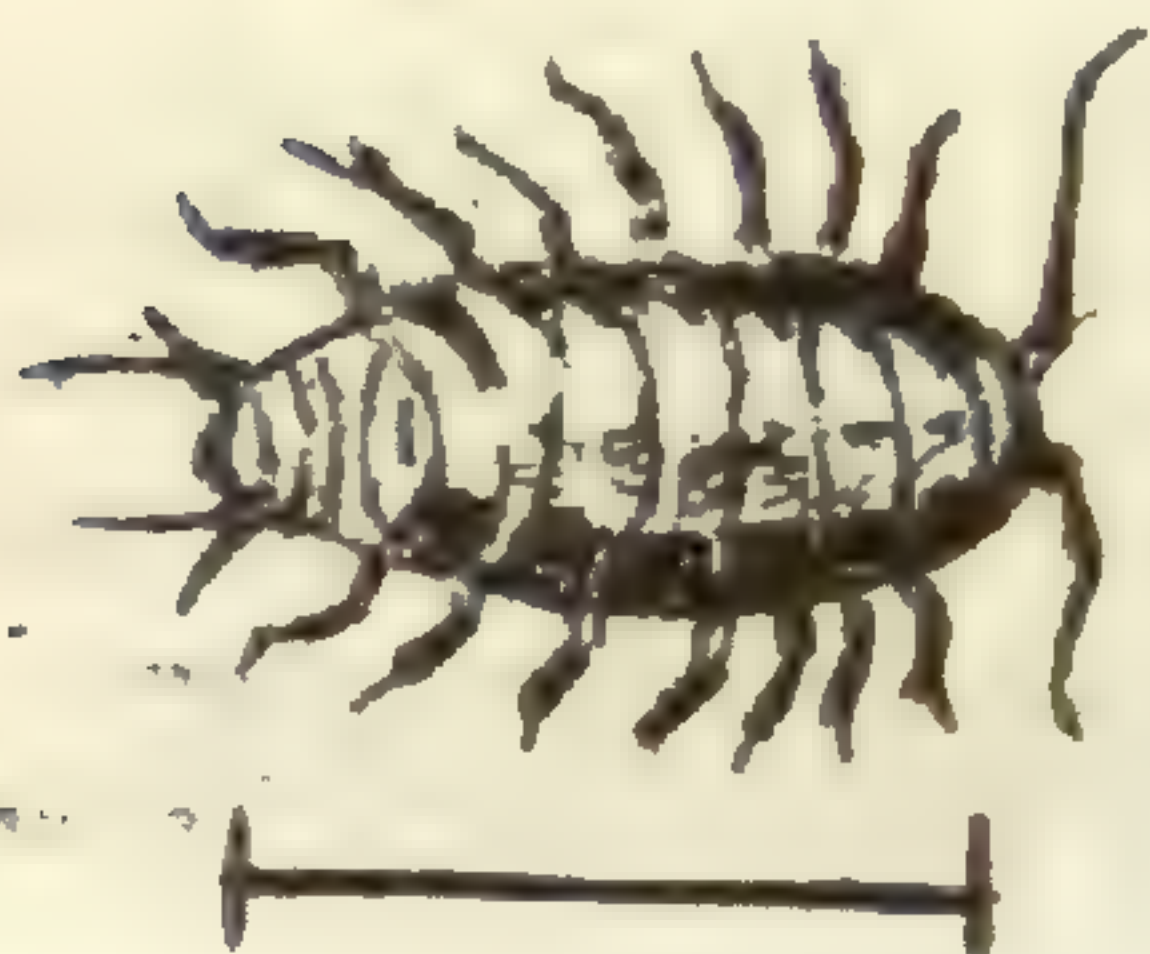
SAP BEETLES: Some feed on bruised and fermenting fruits and may be troublesome in fruit packing sheds, unless control measures are in effect. One species, fruit bud beetle, feeds on the opening buds of roses, cotton, and other plants.



SAWFLY LARVAE: These slime covered, slug-like larvae feed on the leaf surface of cherry, plum, pear, and cotoneaster leaves. This gives the foliage a seared or skeletonized appearance. The adults are known as sawflies. Control with DDT spray.



SCALE INSECTS: So named because of their scale-like appearance; eggs are protected under the scale covering until they hatch. The young are rather active creatures and while in this stage are known as "crawlers"; it is then that they are readily controlled with DDT or dimethoate.



SOWBUGS OR PILLBUGS: Not insects. These small, grayish creatures are a nuisance in greenhouses and gardens; usually prevalent in damp, shaded situations. Control with DDT, malathion, sevin, lindane or chlordane.



SPITTLEBUGS: So named because they cover themselves with a frothy, spittle-like substance. They suck sap from various plants and shrubs. Control with lindane, heptachlor, chlordane or methoxychlor spray.



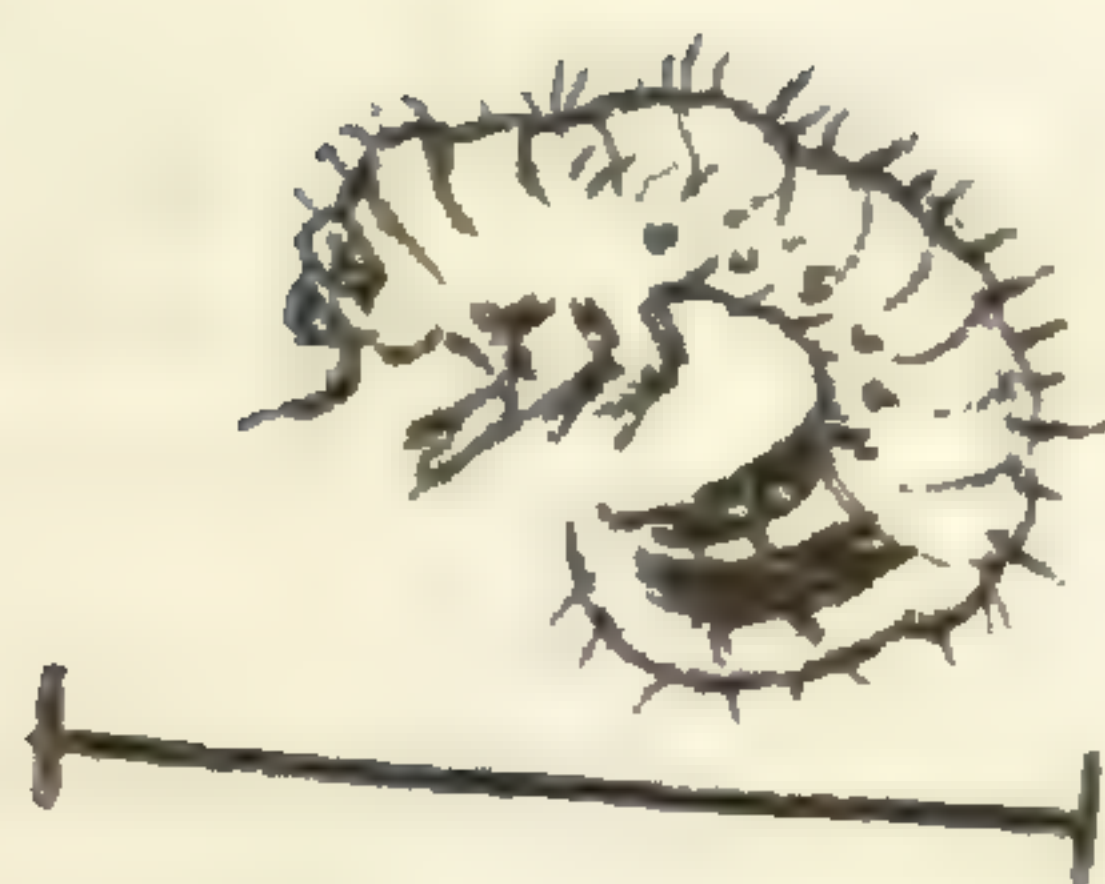
SQUASH BUG: A pest of pumpkin, squash and related vine crops. They feed by sucking the sap. Sabidilla, nicotine sulfate and certain other sprays are used in controlling them.



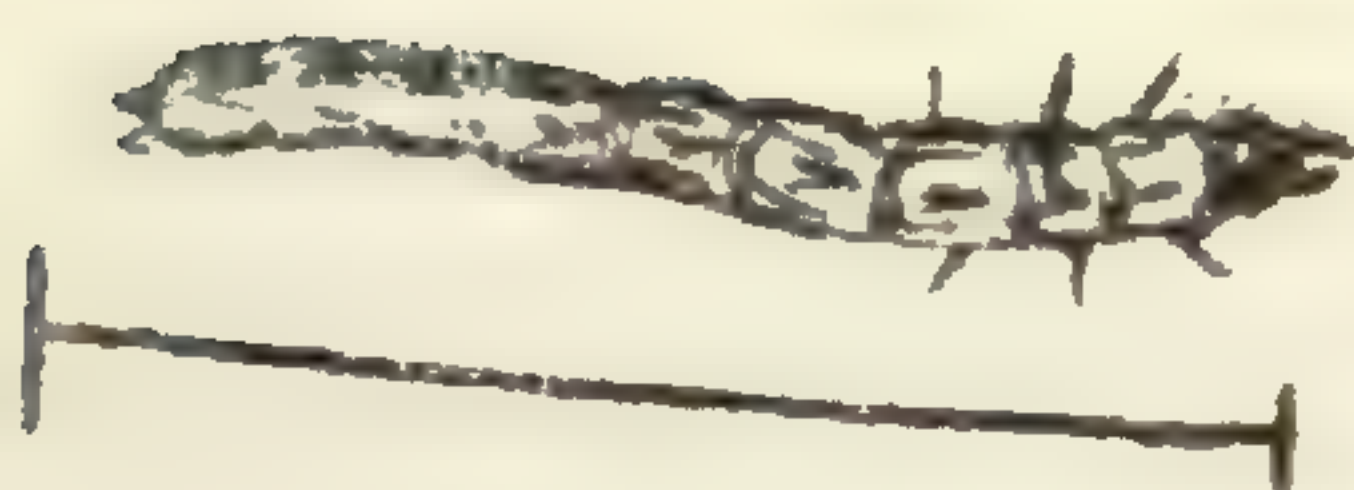
THRIPS: These tiny insects feed by rasping the leaves and tender plant parts; this causes scarring and discoloration of the injured plant tissue. DDT, dieldrin, dimethoate or lindane are used in control.



WEEVIL OR SNOUT BEETLE: Many kinds; characterized by elongated heads, hence the name of snout-beetles. Larvae of the cribrate weevil and vegetable weevil are especially injurious to the roots of various plants and shrubs. Control by treating soil with dieldrin or guthion.



WHITE GRUBS: They include a number of closely related species. The beetles feed on foliage, whereas the larvae or grubs feed mainly on the roots. Soil treatment with aldrin, chlordane or dieldrin will kill the grubs.



WIREWORMS: So named because of their wiry appearance. The larvae are somewhat amber colored; they are especially injurious to germinating seeds. Treating the seed with aldrin, dieldrin, lindane or heptachlor, just prior to planting, destroys the worms.

Report on Hibiscus Project

by ROSS H. GAST

This quarterly report on the Hibiscus Project has been delayed to obtain more time to observe and evaluate our crop of seedlings-plants from seed obtained from crosses made during the winter 1963-64. Only about 60 per cent of them have bloomed, but as precocious blooming habit is an important commercial requirement, we can assume that most of the best of our 1963-64 seedlings have been seen, and their characteristics recorded.

As previously reported, the 1963-64 hybridizing season was mainly confined to crossing the common, well adapted cultivars now in the local trade, with several other blood lines. The principal objective was to make as many crosses as possible between the limited number of common varieties which produce viable pollen or seed with several hybrids derived from either *H. arnettianus* or *H. punuluensis* (Hawaiian native species). Over the years such hybrids produce very strong plants and good roots, although they are not always free bloomers, and it was hoped that the infusion of the common hibiscus "blood" might improve the blooming characteristics.

Apparently this hope has been realized, but to be sure another year of testing will be necessary. A dozen or more candidates for testing have been selected.

A second line of approach during the 1963-64 hybridizing season was to use the common varieties with some of the more sophisticated Hawaiian hybrids of recent origin, cultivars originated by August Miller and Arthur Nagae of Honolulu. Such hybrids do not always do well under conditions here, and it was hoped that some of the bloom quality could be retained when they were crossed with cultivars better adapted to our conditions. However, most of the crosses produced flowers very much inferior to the hybrids, and not much better than those produced by the common varieties. No improvement in plant vigor was apparent.

Quite a bit of selfing and back crossing under a carefully worked out program was done using hybrids on which a four or five generations "pedigree" has been obtained. However, no report on any important results from this effort is available at this time.

Perhaps the most important finding during the past year has been made possible by bringing the project under glass. In the past it has required 18 to 30 months to bring seedlings into bloom, but in the greenhouse many seedlings bloomed in 9 months and most of them in 12 months. Almost all of them would have bloomed in 12 months if they had been left in the greenhouse; however, because of the lack of space 60 per cent of the seedlings were moved outside early this summer.

Bringing seedlings to flower earlier under glass, confirmed, on a large scale, some observations as to seed production made in other years, thus fully establishing hybridizing techniques that will enable a speed-up of the program.

The very sparse literature on hibiscus hybridization recommends that when crossing is successful, one must select "old, established plants" as only such plants will produce seed. Some years ago, it was found by experimentation that the first blooms produced by seedlings produced seed readily. This year, this was tried out on a large scale and proved without a doubt the seed can be produced on very young plants even more satisfactorily than on older ones. Plants which were from seed planted in February, 1963 and brought to the Arboretum greenhouse as tiny seedlings in April, 1963, bloomed in

December were pollinated and produced seed which are now plants of gallon can size. Thus, two and possible three generations can be obtained in the same time as was required for one at Lux, a very important factor in the advancement of the project.

Records were kept of the time of day that crosses were made. These indicated that successful crosses were not limited to the morning hours, as is commonly believed, but can be secured at any time of the day. Of course, there is some variation as to derivation of the hybrids; for instance, pollen from the native Hawaiian species and many F_1 hybrids of these species, is most successfully used the second day, perhaps due to the fact that the Hawaiian species do not open until early afternoon in this area.

Some selections were made from the 1957-58 Lux seedlings which were put in the greenhouse last winter as grafts. At least three are worthy of introduction at this time, and these have been rooted so that they can be planted out next year for scionwood distribution. Also, when released from quarantine, there is another candidate in the material shipped in last winter.

A large number of plants from the wood were sent from the South Seas, New Zealand, Australia, and Singapore last winter. There are several excellent commercial prospects among them, and they should prove to be valuable in breeding work when they are released.

Several months ago, a mist system was established in the greenhouse, similar to that used by most nurseries propagating hibiscus, and set up just as a commercial operation is carried on as to heat, rooting media, etc. Rooting tests have been made of all the candidates for release, and of many other cultivars, building up a valuable body of data in this respect. Nurseries will not grow an hibiscus cultivar that does not root easily, so such tests are necessary.

Last spring seed of a large number of hibiscus species, mainly annuals and biennials, as well as some *Gossypiums* were collected in Australia and Singapore. All of these seed have been planted, and in some cases, plants from them are in bloom. However, they will be kept in the greenhouse until next spring before they are turned over to Mr. Ching for planting in the Tropical Section. Some crosses have been made, mainly with *H. sine-syriacus*, and while it may be a bit premature to report on the matter, one seed pod is set on this interesting species, the result of an interspecific cross, the pollen plant being *H. syriacus*.

BOOK REVIEWS

FLOWERING TREES FOR YEAR-ROUND COLOR IN SOUTHERN CALIFORNIA by Dr. Samuel Ayres, Jr., Philip Chandler, et al. Photography by Ralph Cornell. (California Arboretum Foundation, Inc. Booklet, \$1.50)

This is a delightful new booklet on flowering trees, prepared under the direction of Dr. Samuel Ayres, and published jointly by Los Angeles Beautiful, California Arboretum Foundation Inc. and the Southern California Horticultural Institute.

Thirty pages contain superb color photographs by Ralph Cornell, well-known landscape architect and expert photographer. A descriptive text by Philip Edward Chandler, horticultural consultant, tells when these trees are in bloom, their common names, botanical families, countries of their origin and cultural requirements. Some new and unusual varieties of familiar trees are described, such as the brilliant Coral Trees, the *baubini*as or Orchid Trees, the Crepe Myrtles, the *brachychitons* or Flame Trees, jacarandas, acacias and eucalypti. Qualified to contribute arresting beauty and interest, some of the less-known trees pictured are *Hymenosporum flavum* from Australia with its honey-scented, tubular, cream and gold flowers; the New Zealand Christmas Tree covered with conspicuous fluffs of red stamens; the *Calodendron capense* or Cape Chestnut from South Africa; the rare *Tipuana tipu* or Tipu Tree from southern Brazil; the long-stamened gold and orange flowers of the Moreton Bay Chestnut and *Chorisia speciosa* or Silk Floss Tree with its spine-studded trunk and orchid-pink flowers.

In every case the size and habit of growth are given, indicating the suitability of the tree for small or large gardens, for parks or street parkings.

All tree-lovers will agree that this booklet fills a long-time need. It will go a long way to prove that Dr. Ayres' dream of Southern California as a land of Flowering Trees with year-round color can become a reality.

Mira Culin Saunders.

BOOK REVIEWS

LET'S GROW LILIES! *by the North American Lily Society with text and drawings by Virginia Howie.* (North American Lily Society, 21 Oakland St., Lexington 73, Mass. Booklet \$1.00)

"Let's Grow Lilies" is forty-eight pages of down-to-earth information on lily culture that should be on every gardener's bookshelf. It is well written, well organized for subject matter, and Virginia Howie's drawings are a delightful way of proving the old Chinese proverb: "One picture is worth ten thousand words."

The first chapter poses the question, "Why grow lilies", and proceeds to give a very adequate answer. Subsequent chapters cover the subjects of lilies that are not lilies, a very concise and easily understood discussion of the types of lilies, and, of course, culture. While the cultural instructions are apparently written with colder climates in mind, the principles set forth apply anywhere.

The chapters on propagation, container growing, and exhibiting present the information on these aspect of lily growing in a manner that should make new converts to lily growing.

The concluding chapters include a glossary of terms used, (lily language), a short bibliography of lily literature, list of all the lily societies in the world and a note on how to keep informed on lily matters.

George Spaulding.

SEED PROPOGATION OF NATIVE CALIFORNIA PLANTS *by Dara Emery.* (Santa Barbara Botanic Garden, Santa Barbara, California. Leaflet \$.50)

Home gardeners who wish to use native California plants in their gardens are often stymied by the lack of commercial sources for these plants. Here is a guide published by the Santa Barbara Botanic Garden that is a complete compedium of information on the collection and germination of native plant seeds. It gives detailed directions on the scarification and other treatments necessary to induce germination, how to sow seed and transplant seedlings.

Over 400 varieties of native plants are indexed with common and scientific names and the recommended seed treatment required for each. The Santa Barbara Botanic Garden was founded for the display and study of the plants of California and the information presented by Dara Emery is based mainly on her experiences at the Garden. It gives her authoritative guidance in this complex field to all who are interested.

R.E.A.



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CALENDAR OF EVENTS

1964 - 1965

(complete details will be announced before each event)

October 17-18—Gordon Guiberson Oriental Garden, Bel Air, Calif. Tour and Tea
The outstanding event of the fall season.

October 30—Fall Flower Show Preview
Invitational to members and their friends. Preview showing of the Fall Flower Show, sponsored jointly with the Independent-Star News.

November 6—Dr. C. R. DePrima Lecture
An unusual opportunity to see slides and hear a "people and places" report on Russia, specifically the Georgian area, presented by our member, Dr. DePrima, of California Institute of Technology.

December 13—Christmas Program

January 22—Dr. Jack Fowlie and Mr. Glenn Hiatt Lecture
A slide illustrated lecture on the recent orchid collecting trip to Guatemala and Costa Rica.

February 6—Arboretum Tour.

March 4—Arboretum Day at the Races

March 26—Dr. William S. Stewart Lecture
This lecture you will surely enjoy. Dr. Stewart will have just returned from India and will provide much information about his experience there.

April (day to be announced)—Garden Fashion Show and Tea
For the ladies—but gentlemen are cordially invited to attend. Invitations will be sent you at a later time and complete details announced. This event will help to increase the Peacock Pavilion Fund.

May 18—Annual Membership Meeting
The regular Annual Membership meeting, election of Trustees, plant distribution—a get-acquainted session and tea. Special tours of the Arboretum will be provided.



SMOG



MELALEUCA LINARIIFOLIA

MISSOURI BOTANICAL

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COVER PICTURE

Flax leaf Paperbark, *Melaleuca linariifolia*, an Arboretum introduction in 1960, is described on page 14 of this issue. Color photographs by Charles Kassler of Pasadena, California.

IN THIS ISSUE:



Wilfred Noble

Smog is a word coined in Los Angeles from smoke and fog. In the days before World War II, whenever oil was burned in the citrus groves to keep the temperatures above freezing, a heavy black smoke was created that hung over the city and was carried back and forth by the winds off the ocean and from the desert. When this smoke, largely carbon, was mixed with the frequent fogs, the result was an almost total reduction in visibility.

During the war (1941-1945), new processes were introduced into the refining of gasoline giving rise to compounds which remained after the gasoline was burned in the gasoline engine. Early damage was greatest near the refineries and it became obvious that gases originating here were the principal cause. Meanwhile, improvements in the orchard heaters, making them more efficient burners, almost eliminated their smoke. But when these gasoline derivatives of the "cracking" process

accumulated in the air on a foggy day (i.e., when an inversion layer existed), the result was a brownish pall that resembled the smog of previous years. When the emissions from the refineries were brought under partial control, the automobile became the principal source.

This new smog caused severe losses to the vegetable growers and other farmers in the area, but it wreaked its greatest havoc for the growers of ornamental crops. Cattleya orchids were so damaged by the "dry sepal disease", eventually traced to smog, that the growers moved virtually *en masse* to the Santa Barbara area.

This new smog caused eye irritation and lung congestion of varying degrees. The fact that on days of severe smog plants were also affected led to the work reported here.

More research into the causes of smog damage to plants has been done in Southern California than anywhere else in the world and a leader in smog investigations has been the author of this monograph, Wilfred M. Noble. He is presently associated with the Arboretum and with the U. S. Department of Health, Education and Welfare, studying the effect of air pollutants on plants.

Born in Brooklyn, New York, Mr. Noble graduated from the University of Redlands and was awarded the M.A. Degree at the University of Southern California. He was with the Los Angeles County Air Pollution Control from 1948 until he was retired in 1964.

THE EDITOR

Smog Damage to Plants

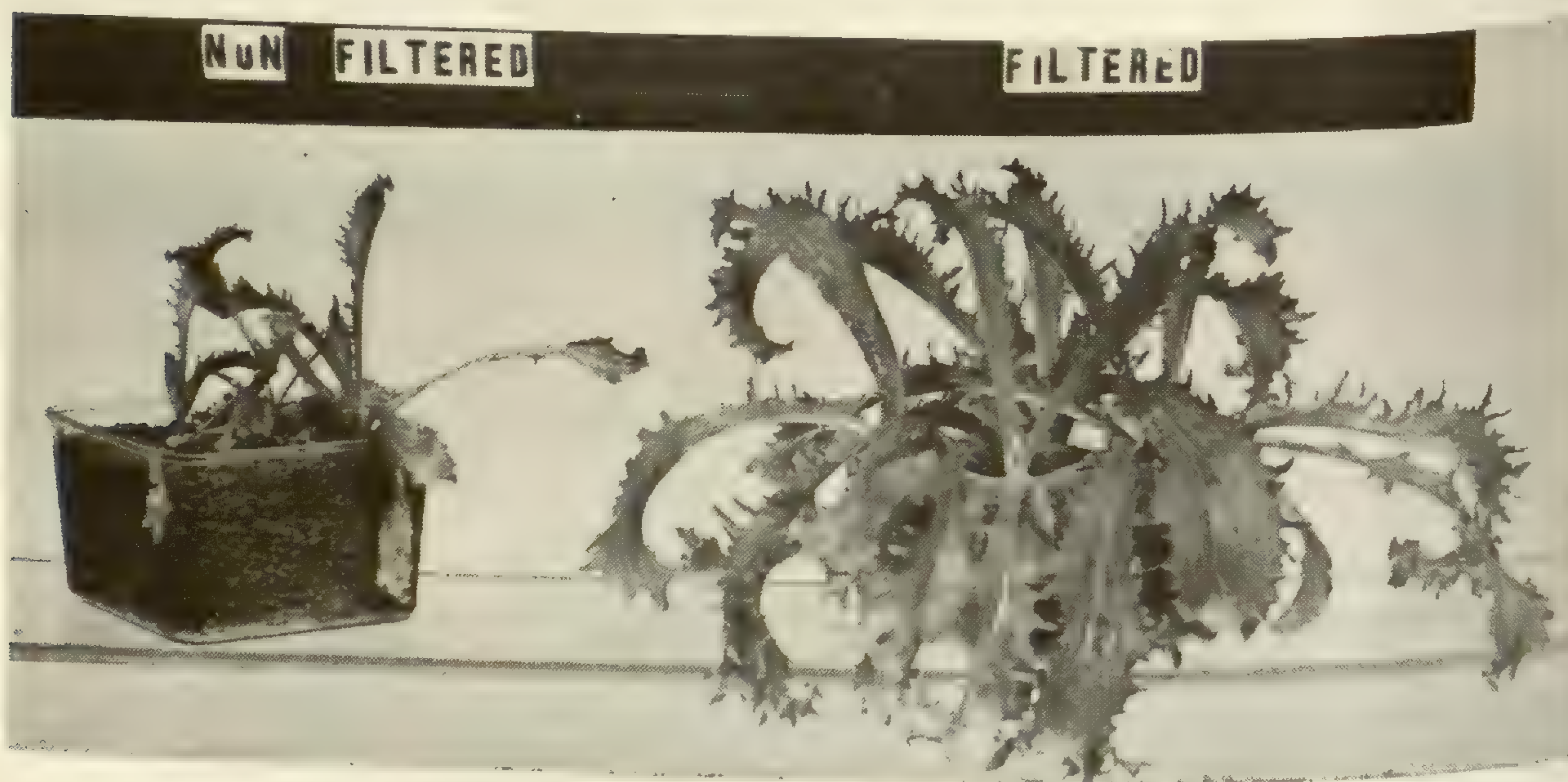
by WILFRED NOBLE

The damage caused by deleterious gases on vegetation has been observed and reported throughout the world, especially damage caused by excessive sulfur dioxide. (1).

In the Los Angeles area, the symptoms are entirely different than those reported for sulfur dioxide. Prior to their discovery here, such symptoms as silvering, banding and stippling had never been reported. The first observation of any injury was in 1942 when a nurseryman in Temple City found this type of damage on the under surface of the leaves of young petunia plants. The following year a farmer in South El Monte noticed the discoloration of lettuce, endive and celery, and complaints from the marketing outlets led him to change to other crops which were not affected.

In 1944 farmers in and around Dominguez complained about a peculiar type of injury affecting their crops which was investigated by the Citrus Experiment Station in Riverside.

By 1949 the annual damage from smog was estimated at \$500,000 (2) by workers at the Citrus Experiment Station, but this figure might have been underestimated, since all the forms of injury now known to occur were not recognized at that time. By 1956 the annual damage was estimated at 5 million dollars. (3). But with all this investigation, the exact cause of the damage was still unknown.



Effect of smog on the growth of endive. Small plants grown in ordinary air, large plants protected by activated carbon filter.



Sycamores grown four months in filtered and in unfiltered air showing reduction in growth and severe damage to older leaves.

It was observed that plant damage and eye irritation nearly always occurred at the same time, indicating they were probably due to the same or to related substances. The fact that plants showed such unusual symptoms provided an invaluable material for testing the various chemicals suspected.

Research projects were set up at the Stanford Research Institute, sponsored by industry, and at the Earhart Research Laboratory at the California Institute of Technology. The latter laboratory, under the direction of Dr. Frits Went, had just been completed and provided a broad range of growing conditions. After considerable study it was determined that the only satisfactory means for growing undamaged plants was to filter the air through activated carbon. So growing and fumigating rooms using these filters were then set up. Tests were conducted under the joint sponsorship of the California Institute of Technology, the Los Angeles County Air Pollution Control District and the University of California.

Over 50 substances known or suspected of being present in the atmosphere were tested with negative results. At this time, Dr. A. J. Haagen-Smit joined the project and suggested that the damaging material might not be a simple substance, but two or more substances reacting in the atmosphere under the effect of sunlight. Following his suggestion, it was finally determined that unsaturated hydrocarbons coming from cars and refineries would combine with oxides of nitrogen under the influence of sunlight to form a substance which would produce the symptoms observed in the field. (4). This work was later confirmed by the Stanford Research Institute and others.

At this time plant damage and eye irritation were the only means of measuring the actual harmful pollutant. Eye irritation was not reliable, since controlled conditions for measuring it were very difficult to achieve. On the other hand, the amount of damage could be determined on plants raised under carefully controlled conditions and exposed for a single day.

Two such projects were set up to pursue this study. The program at the University of California, using pinto beans, was abandoned after one year. The Los Angeles County Air Pollution Control District, using blue grass and petunia (both very sensitive), continued the work for six years from 1954 to 1961.

At the present time several trends are apparent. The frequency of severe injury seems to be decreasing; however, the frequency of light injury seems to be on the increase. The regions covered by damage are increasing in most major cities and in areas bordering on metropolitan centers.

The result of air pollution in Los Angeles County has been a considerable reduction in agriculture, but perhaps more importantly has been the serious effect on ornamentals. Many nurserymen have been forced to leave this area in order to survive; others have changed to more resistant although sometimes less profitable material. Ornamental losses are more difficult to calculate than farm losses.

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Protection of Plants

When it became apparent that an immediate reduction in plant-damaging air pollution was not probable, a search began for some method of reducing the effects on vegetation. Among the protectants studied were dusts, sprays, and nutrients. Kendrick (1) reported some effect from two commercial dusts, Zineb and Maneb. Subsequently, Freebairn (2) reported that vitamin C was also effective.

In the meantime, similar work had been started at the Aboretum under a Public Health grant. The first results of this project were published in 1963 (3) and showed that reduced glutathione was effective in alleviating the effects of natural air pollution. Subsequent studies showed that gum guaiac was an effective material for removing from the air both naturally occurring air pollution and ozone alone. (4).

Recent experiments have shown that gum guaiac dusted directly on leaves will protect the plants from heavy ozone concentrations. One leaf of a pair of primary leaves of a pinto bean was dusted with the gum and the plant then exposed several hours to a high concentration of ozone. The undusted leaf was severely injured while the dusted leaf showed only slight damage. In another experiment, using *Nicotiana glutinosa*, one half of each leaf was dusted with the gum and the plant then exposed to a high concentration of ozone. The undusted halves were severely damaged while the dusted halves showed little to no injury, depending on the leaf age. Field studies of this material remain to be made, since no material pollution has occurred subsequent to these findings.

Reported here for the first time, propyl gallate is another substance which shows considerable promise. In one experiment, using again the primary leaves of pinto bean, one half of each leaf was painted with a 0.35% solution of propyl gallate in water, and the plant exposed to over 10 parts per million of ozone for 2½ hours. Definite protection was observed on the painted halves. Protection was noted in another experiment, when one of the primary leaves of the pinto bean was sprayed with the 0.35% propyl gallate and the plant exposed to a lower ozone concentration. At this concentration of propyl gallate, some spray injury has been noted.

Presently in progress are studies using lower concentrations of both the ozone and propyl gallate. Also plants have been sprayed and exposed to the atmosphere, but so far insufficient pollution has occurred to cause any injury to the unprotected plants, therefore, no conclusions can be drawn at this time. As soon as conditions of sufficient pollution prevail, field tests will be made. In these it is planned to use White Cascade petunia, found to be one of the most sensitive plants so far observed.

Beside the work being done by public institutions, studies are also being made of protectants by some commercial organizations. These, too, are in a preliminary stage.

At the present time, no recommendations can be made concerning these new materials. It is hoped that field studies can be made as soon as conditions permit, and helpful information released to the public concerning the use of any products of practical value.

LASCA LEAVES



Pinto bean leaf which was exposed to a high concentration of ozone after half of the leaf had been sprayed with a weak solution of propyl gallate.

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NOTE: This investigation was supported by Public Health Service Research Grant No. AP 00132-06 from the National Institute of Health, Washington, D.C.

Air Pollutants

Smog, the term commonly used to refer to air pollutants in general, technically applies to smoke and fog as presently found in London where it is still a critical problem. Used in this sense, however, the term applies to the atmospheric condition in only a few areas at the present time. The serious air pollution in the Los Angeles area, and being discovered in many other areas, is neither smoke nor fog. One of its chief characteristics is its high ozone concentration and the resulting strong oxidizing ability. It cracks rubber, causes eye irritation and damages plants in a very specific manner. After years of careful study, some of the components of this pollution have been sorted out. This section discusses the more important ones, their effects on vegetation, and lists a number of sensitive and resistant plants.

Regarding sensitivity, it must be pointed out that plants are most sensitive when young. Petunias are more sensitive in the 4 to 7 leaf stage than at any other time. Small seedling pansies are quite sensitive, but plants in the flowering stage are rarely injured. Therefore, any lists of resistant plants are actually relative to the state of growth.

PAN

This term refers in general to a group of compounds belonging to the chemical family of peroxyacylnitrates or more specifically to one member of the group, peroxyacetyl nitrate. (1) This compound and others related to it have been shown to produce the major symptoms observed on days of high pollution when plant damage occurs. (2) These symptoms are as follows:

Silvering: This occurs on the lower surface of the leaves of plants, such as spinach, chard, beets, petunia, and snapdragon. It varies in expression from a silvery appearance on spinach to a bronze on table beet and a milky white on snapdragon. Small plants and young leaves are most sensitive.

Banding: Found on most sensitive plants, banding is probably the most common symptom. Because cells of young leaves at one brief stage of growth are far more sensitive than at any other time, and since most leaves mature progressively, successive bands across the leaves are produced by smog each day it occurs. This symptom is readily observed on grasses, such as annual blue grass, wild and cultivated oats, barley, and occasionally on kikuyu and rye. It is also apparent on mimulus, fuchsia, petunia, and snapdragon.

Growth reduction: This is a very serious, though less obvious symptom, since to observe it plants also must grow in smog-free air for comparison. As much as 90% reduction in growth has been noted over a period of several months on some young plants grown in ordinary air compared to identical plants grown in filtered air for the same length of time.



Pan type damage to petunia. Injury occurs at the tip of the youngest mature leaf and moves toward the base of the oldest damaged leaf with no injury to young immature leaves or to the older mature leaves, a most specific common symptom.

Cellular collapse: This, of course, can be observed only with a microscope. Cells in the interior of the leaf surrounding the stomata collapse and dehydrate without disconnecting from each other and the space which they occupied becomes filled with air. This accounts for the silvering and banding—silvering on leaves with a well-developed palisade layer, which appears to be resistant, and damage completely through leaves with no palisade, such as endive, grasses, or very succulent petunia. (3).

The following is a list of some of the more sensitive and resistant plants to the PAN type of damage:

CROPS

SENSITIVE		RESISTANT	
spinach	beet	cabbage	onion
endive	celery	cauliflower	corn
romaine lettuce	pepper	rhubarb	cucumber
swiss chard	tobacco	carrot	strawberry
alfalfa		squash	

ORNAMENTALS

SENSITIVE		RESISTANT	
petunia	sweet basil	trees	orchids
mimulus	fuchsia	woody shrubs	coleus
snapdragon	impatiens	cactaceae	cyclamen
primrose	mint	anthurium	ivy
aster	ranunculus	bromiliad	narcissus
		calendula	lily
		camellia	portulaca
		carnation	most house plants

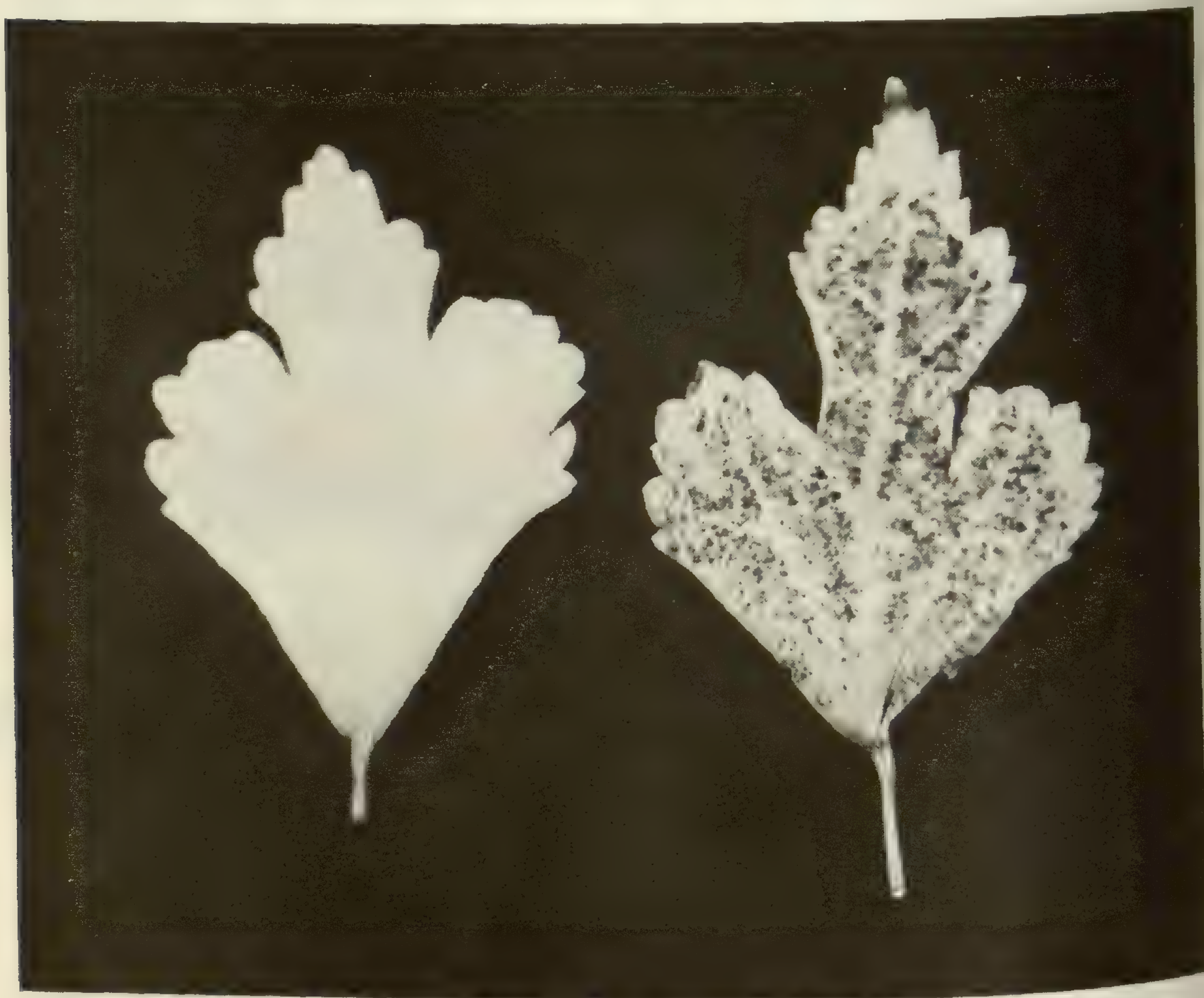
WEEDS

SENSITIVE

annual blue grass	cress
pigweed	jimson weed
chickweed	dock
wild oat	ground cherry
mustard	

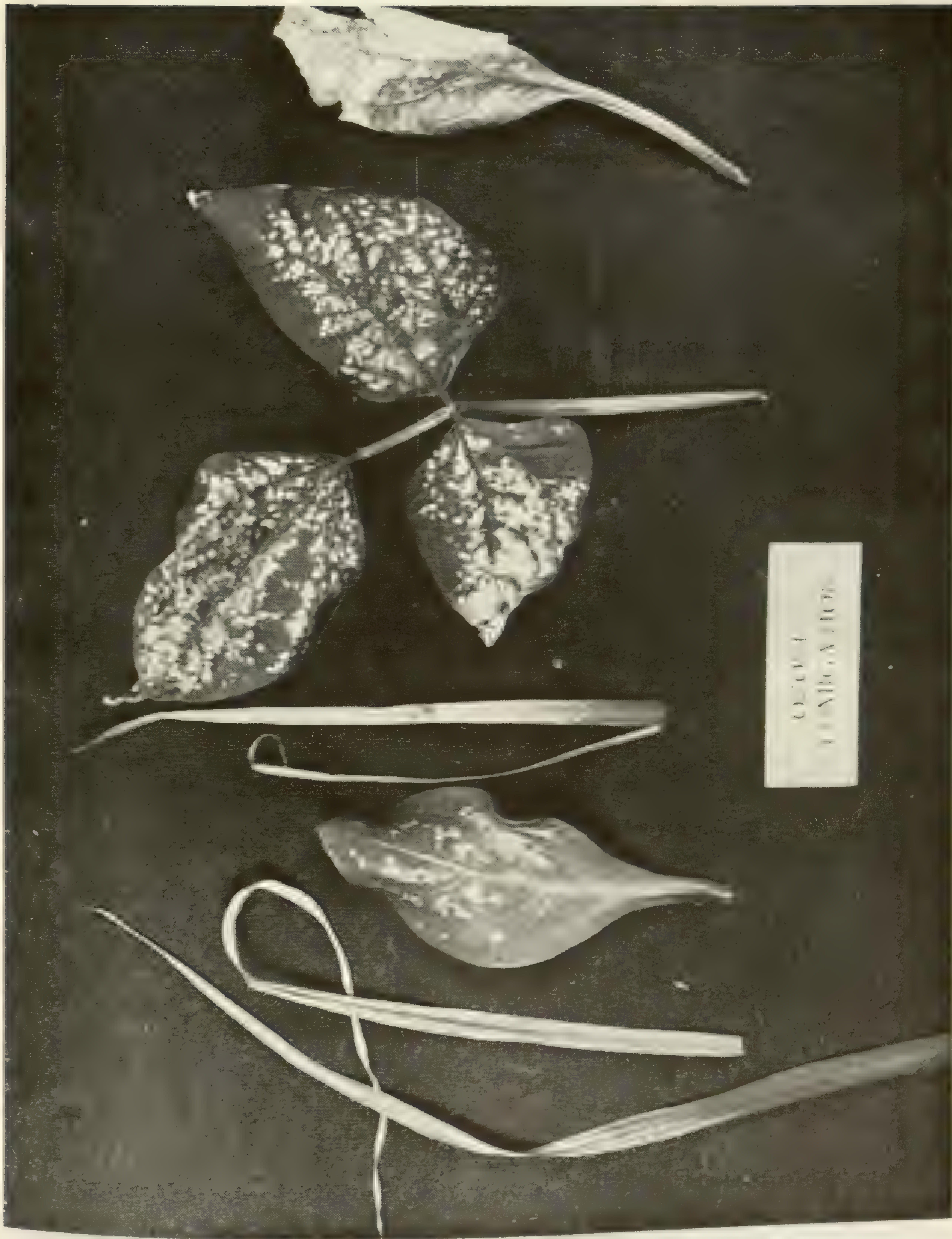
OZONE

Ozone, like PAN, is a product of the hydrocarbon—nitrogen oxide reaction in the sunlight. More ozone damage is being observed than was first suspected. This could be due to an increase in the amount of injury, a better knowledge of its symptoms or both. In higher concentrations it sometimes causes injury similar in some ways to that caused by PAN. However, this is not usual and may be distinguished easily by a careful observer.



Hibiscus syriacus. No injury is apparent on the lower surface while a heavy brown-black stipple attributed to ozone appears on the upper surface.

The chief distinction of ozone injury is that it primarily attacks the older leaves and particularly affects woody plants. In contrast to PAN, which attacks the lower leaf surface, ozone affects the palisade layer of the upper surface, causing small clusters of cells to darken and eventually turn brown-black. This was first noticed on grapes and studied by Richards. (4) Leaves thus affected turn yellow and drop prematurely.



Ozone damage caused by a heavy fumigation. Plants are not petunia *P. axillaris* (annual blue grass) pinto bean, and spinach. Damage is general to older leaves.

SOME OF THE COMMON PLANTS AFFECTED BY OZONE

alder	maple-leaf mulberry	chrysanthemum
azalea	orchid tree	fig
buttonwood	sage	fuchsia
carob	walnut	locust
elm	avocado	maple (silver)
flowering maple	box elder	pepper tree
hibiscus	California allspice	sycamore
fibrous begonia	nicotiana	willow
		morning glory



Ozone stipple on red locust. The more severely damaged older leaves were yellow in May and were beginning to drop.



MELALEUCA LINARIIFOLIA

Melaleuca linariifolia

ARBORETUM INTRODUCTION — 1960

Common Name	:	Flax leaf Paperbark
Scientific Name	:	<i>Melaleuca linariifolia</i> , J. E. Smith, Trans. Linn. Soc. London 3:278. 1797; Exot. Bot. 1:109. pl. 56. 1805.
Family	:	Myrtaceae
Origin	:	New South Wales and Queensland, Australia
Form	:	Tree—10-30 feet
Flowers	:	Showy white fluffy-flowers in profusion in May and June
Foliage	:	Narrow oval to 1 inch long—evergreen
Growth Rate	:	Rapid—2-3 feet per year
Soil Requirement	:	Tolerant of variety of soils but grows best in medium loam
Exposure	:	Full sun
Temperature Tolerance	:	To 25°—possibly less
Water Needs	:	Moderate to heavy depending on soil (Plant comes from swampy areas)
Pruning	:	Only what is necessary to form tree or remove dead wood. Occasional shortening of long branches reduces chance of breaking in high winds
Pests	:	None of record
Disease	:	None of record
Propagation	:	Seed—germinates readily in about 10 days
Remarks	:	A very showy tree when in bloom and pleasing in appearance when not in bloom. The bark is papery and flakes off in strips. It is very attractive.

January 22, 1965

To the Editor:

I've watched with interest the developing use of color in Lasca Leaves, but the innovation in the October issue of 1964, recently received, invites some criticism. I hope the following comments are in order and that some alteration in editorial policy can be made before the family of errors is repeated.

The insert is lovely and the idea is good. However, it has no pagination and therefore can not be cited in further scientific publications. Although the color insert repeats the cover, in our copy the color reproduction is actually better on the insert than on the cover. The cover carries the common name but not the scientific name given on the insert. The explanation of the cover (inside front cover) repeats the common name, as does the table of contents. Consider your future reader who lacks the insert someone placed on the "potting shed wall" and now can not identify by scientific name the cover of Vol. VIX. No. 4. To keep friends remember it is the Republic of South Africa, not the 'Union of'. On the insert: the generic name is *Osteospermum*. The Scientific or Latin name is *Osteospermum fruiticosum* (L.) Norlindh. The reference to "Supp XI Kew. 173," is without any meaning. Norlindh (note no period. that is his name) made the combination in his Studies of Calendula, not in the supplement of Index Kewensis. According to Index Kewensis, Lessing did not make the combination in *Dimorphotheca*. De Candolle did. I won't add many more to your woes—just that the index carries no reference to the good color which I hope remains a feature of Lasca Leaves.

I'm sympathetic to the problem of keeping editorial consistency in such a magazine, but I hope all of us try to give the public the correct botanical names properly used.

Sincerely,

(Signed) RICHARD A. HOWARD, Director

The Arnold Arboretum, Cambridge, Massachusetts

Thank you, Dr. Howard, for your constructive criticisms.—Ed.

ETHYLENE

Ethylene is a simple, unreacted hydrocarbon of lower molecular weight and, unlike PAN and ozone, is not easily removed by carbon filters. Ethylene injury has been known for many years (5), but only two plants have shown serious symptoms: orchids and carnations. One instance of injury to peas has been observed at the California Institute of Technology. One of the few pollutants which affects the blossom, this gas causes what is known as dry sepal on orchids. The sepals age prematurely and, in severe cases, even turn brown before the bud opens. Losses to orchid growers are quite severe and many have left the area or have moved in from the coastal areas where injury is most severe. Ethylene is one of the major problems in the San Francisco region where many orchids are grown.

Injury to carnations is not very common. It is, however, strange. The opened blossom reverts back to a bud, an effect called "sleepiness".

Ethylene causes peculiar effects on plants other than orchid and carnation and many have been described by Crocker. (5) However, with the single exception of peas, none has been observed in this area.

HYDROGEN FLUORIDE



Yucca with dark brown marginal and tip injury typical of fluorine.

Fluoride damage is less common in the Los Angeles basin than in many other industrial areas since few major industries here produce this pollutant. However, a number of ceramic plants cause local injury to vegetation. Fluoride gases are released when clays and frits are heated to high temperatures. These compounds are cumulative when absorbed by plants and are translocated within the plant, concentrating in the tips and edges of the leaves. There they cause a cocoa brown discoloration with well defined borders. Very low concentrations over an extended period of time are therefore capable of causing severe damage near the source. Many plants are affected by these gases and extensive lists of sensitivity have been published. (6).

The list which follows include a few on which damage has been observed in Southern California:

PLANTS SENSITIVE TO
HYDROGEN FLUORIDE

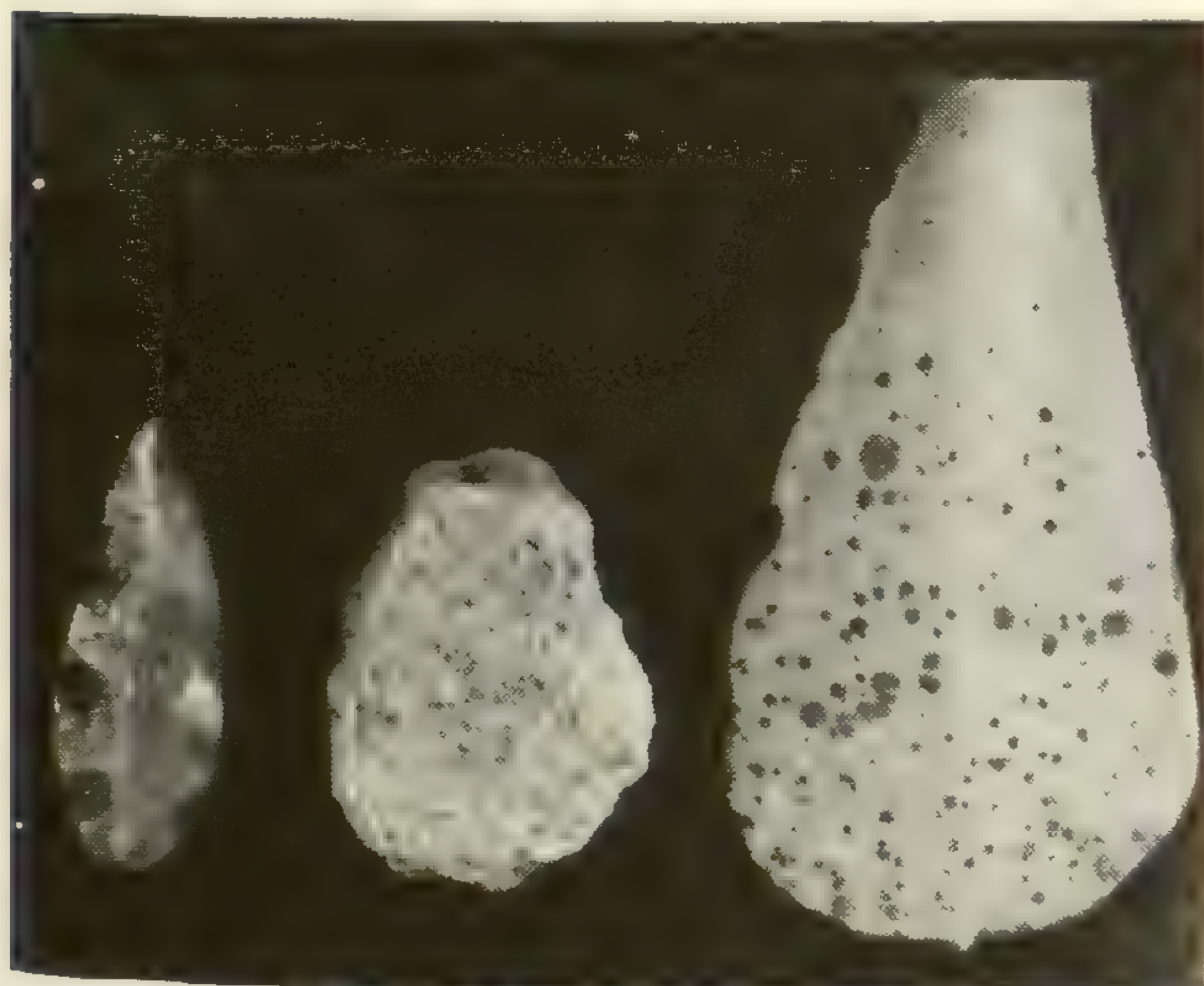
gladiola	yucca
Monterey pine	iris
elm	magnolia
viburnum	rose
figus	papyrus
pear	mahoberberis
apricot	strawberry
peach	grape
tomato	eucalyptus
sunflower	bottle brush



Liquidambar leaves affected by fluoride.

SULPHUR DIOXIDE

Sulfur dioxide concentrations in the Los Angeles area are low for a large industrial center. Plant damage from this cause is therefore very light and normally occurs only in case of an accident in an industrial plant where this gas is used. In these few instances, only a small area around the source is affected. Acute injury appears as a tan to paper white area between the veins, with most severe symptoms appearing on the younger leaves. On a few occasions sulfur dioxide injury has coincided with that caused by PAN and ozone, thus producing severe damage whose cause was difficult to determine from plant observations alone. Since this injury is so rare here, we will refer the reader to other sources for more comprehensive lists (6, 7) of sensitive plants and name only the following: alfalfa, spinach, squash, oat, sweet pea, aster, mustard, endive, and clover.



"Aerosol" injury to two leaves and spots on a white rock from outdoor planter. Found in the vicinity of a plant burning heavy residual fuel oil containing sulfur.



Sulphur dioxide damage to a mustard leaf. (Enlarged) Injury appears as completely bleached areas between the veins which stand out dark green.

"AEROSOLS"

The term "aerosol" as used here is actually a misnomer, since these particles or drops are much too large to be so described. However, they have been referred to as such in the past and it is difficult to change the term. These droplets are found in the immediate vicinity of all industrial plants which consume large quantities of heavy residual fuel oil containing considerable amounts of sulfur. They are larger near the source, becoming much smaller at around $\frac{1}{2}$ mile and disappearing within 1 to $1\frac{1}{2}$ miles. Their exact composition has not been completely determined, but they usually contain small, round, sponge-like carbonaceous particles known as cenosphere and, in one instance, an analysis of the residue showed the presence of a considerable amount of iron and a small amount of vanadium.

These droplets will burn holes in leaves and blossoms, in canvas and paint, and will stain white rocks used in outdoor planters. No valid sensitivity list can be given for this type of injury; however, it has been noted that waxy leaves, such as those of a rubber tree or camellia, seem to be less affected.

NOTE: The author wishes to recognize the assistance of Michelle Terry in the study of aerosols.

NITROGEN OXIDES

At the present time, not very much is known about the effect of these gases. It is well known that levels of nitric oxide and of nitrogen dioxide are frequently high in large cities, concentrations of the former often exceeding one part per million. Since these gases are formed in any high combustion process they are very difficult to control. Glater (8) has made some study of this problem and attributes to this cause at least part of the premature aging seen on much vegetation.

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NOTE: Space does not permit this subject of pollutants to be as complete as many readers might desire. We therefore wish to recommend the chapter on "The Effects of Air Pollution on Plants" by Moyer D. Thomas in the World Health Organization Monograph Series, No. 46, the subject of which is Air Pollution. This is a comprehensive review in simple language, with excellent illustrations in color, by an outstanding authority in this field.

Results of a Six-Year Study of Air Pollution using Plant Indicators

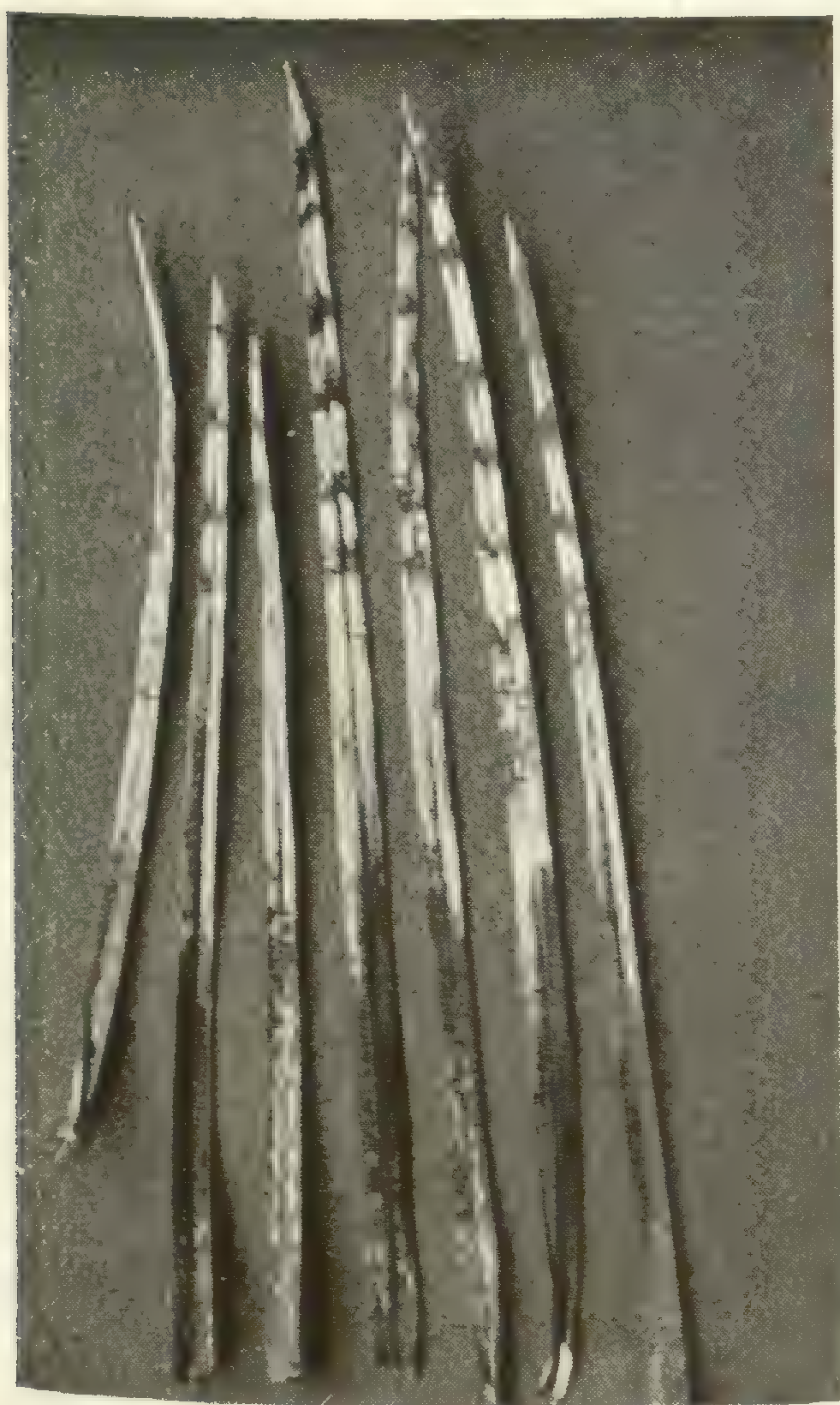
Soon after the discovery that plants in the Los Angeles basin were suffering damage from air pollutants of unknown substance, it became obvious that the plants themselves would prove an excellent biological assay material for the study of air pollution (1). The affected plants were extremely sensitive, some being injured by concentrations so low that the oxidant, the most closely related pollutant measured, read only 0.10 parts per million parts of air. In contrast, eye irritation begins at approximately twice that value.

Plants used in the first experiments were the farm crops whose injury had resulted in severe losses to growers. They included oats, endive, alfalfa, romaine lettuce, spinach and sugar beets.

Further studies with other plants soon revealed some which proved to be more satisfactory because of their reliability and the ease with which they could be grown. Two such plants selected for this project were annual blue grass (*Poa annua*), a common weed found in most turf, and petunia.

Selected because of its uniformity, because a large number of plants could be grown in a very small space and because it could be planted, grown, exposed and evaluated all within a period of less than six weeks, *Poa annua* offered still another important factor. The pollutant produced a band of damage within the blade of the *Poa annua* whose length was an arbitrary measure of the degree of damage. Subsequent to its selection, studies by Bobrov (2) and Juhren (3) showed this to have been a good choice.

Petunia had two advantages — it was most sensitive during those months when the sensitivity of the *Poa annua* was less sensitive and it exhibited the earliest observed symptom, silver leaf, which *Poa* did not.



Series of bands on blades of *Poa annua* of similar age. Each white band was caused by a separate day of smog.



"Silver leaf" injury on petunia. This was the first specific symptom observed.

At first these plants were grown in the Earhart laboratory at the California Institute of Technology. After a year or so, however, the District constructed a well-controlled greenhouse at the Los Angeles State and County Arboretum. Here it was possible to maintain reasonable control over the temperature, humidity, and day length. The plants were grown in an inert medium, vermiculite, and sub-irrigated daily with a modified Hoagland solution. Smog-free air was provided by means of large carbon filters and a positive pressure was maintained within the greenhouse so that any leakage would be outward.

Although considered as a six-year project, the period covered was more than that, since considerable preliminary work was required. One of the most important items was the construction of an exposure chamber. After three preliminary chambers had been built, the final choice was a three-compartment box of aluminum and glass. A lower compartment contained the blower and filter of activated carbon. The two upper chambers were of aluminum with glass on three sides and were identical except for the fact that one chamber received a constant supply of filtered air while the other chamber received an equal supply of ordinary unfiltered air.

Of the fifteen stations in operation, twelve were in the Los Angeles basin, one in Pomona, and two in Antelope Valley. Plants were delivered to each of these stations weekly. Six sets of ten *Poa* and two petunia each were stored in the filtered air, while one set was exposed each day in the unfiltered air and then traded for another set the next day. At the end of the week the exposed plants were brought in, and the damage evaluated and recorded. Daily maps were prepared showing the degree of injury at each station. A report covering a portion of this study has been prepared by the District (4).

Several observations may be made as a result of this project. The frequency of occurrence of moderate and heavy injury of the type which shows the symptoms of silvering and banding appears to have decreased during this period although the frequency of lighter degrees of injury may have increased. This could well be explained by the following facts (1) Extensive controls had been installed on refineries to reduce their losses. (2) The type of gasoline being marketed in the basin contained much less of the primary culprits—unsaturated hydrocarbons. (3) Blow-by devices were now installed on many vehicles. At the same time the population and the number of cars had increased and covered a large area.

It also may be noted that during the period of operation at Henniger's Flat, about half way up Mt. Wilson, damage occurring at this station was nearly as frequent as that in Pasadena. Pollution occasionally reached the Antelope Valley, undoubtedly over the mountains and through the canyons from the Los Angeles basin. Plants in the field in Del Sur showed evidence of two periods of moderately heavy injury early in 1964. At times the type of injury found at the test stations in Antelope Valley differed in some respects from that found in the basin, possibly indicating a somewhat different composition as the pollution reached that area.

Although the District terminated its work with plants early in 1962, this type of analysis has been resumed at the Arboretum and daily observations are being made in the Arcadia area.

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Courtesy: Air Pollution Control District, County of Los Angeles

FACTORS AFFECTING SENSITIVITY

Basically, any environmental condition which promotes luxuriant growth will increase the sensitivity of a plant to smog. One such factor is a high nitrogen fertilizer application. Studies at the Earhart laboratory showed that well-watered plants were also more sensitive than those receiving barely enough water to prevent wilting. Taking advantage of this information, farmers in the Dominguez area have been able to grow such crops as spinach and Romaine lettuce which, although smaller and less tender, were still marketable.

A third factor affecting sensitivity is light. Although studies in this field are limited, it is apparent both from field and from laboratory observations, that a relationship exists between light intensity and degree of injury. On many plants it has been noted that sensitivity increases with shading up to a certain point and then drops off as light decreases. Again farmers have been able to use this fact to advantage. They have found that when spinach is crowded together in rows so that it grows tall and tender it is more severely injured than spinach which has been spaced so as to receive more sunlight on each plant. This reduces the yield per acre, but the crop is more marketable.

Another factor is the age of the plant. Young plants are more sensitive than mature ones. *Ceanothus* has been damaged in the two leaf stage. *Atropa belladonna* at two to eight leaves has been so severely damaged that some plants have even died while duplicate ones in filtered air have grown to maturity. At the same time others protected from smog during early growth continued to maturity in spite of repeated injury. Tree tobacco, quite sensitive in the seedling stage, appears to show little or no damage after reaching a height of about two feet. *Petunia* appears most sensitive around the time it is removed from flats as seedlings and replanted for marketing. This is also true of many other bedding plants. Consequently some method of protection at this stage would be of considerable help to growers. Such studies are now under way at the Arboretum.

TISSUE CULTURE STUDIES

Plant tissue culture studies related to air pollution began at the Los Angeles State and County Arboretum in 1958. These studies were conducted under the auspices of the California Arboretum Foundation on a grant from the United States Public Health Service. In the beginning, the Los Angeles County Air Pollution Control District also gave some support in the way of personnel.

The initial work was conducted by Marcella Juhren on tomato root cultures. This showed that fumigating the root cultures with naturally occurring air pollutants stimulated the growth of tertiary roots. Following this, the work was continued by Arthur Lanz employing cultures of carrot roots. Since a definite effect was noted here, a study to determine the efficacy of various substances was begun in an attempt to find something which might protect plants from smog.

When chemicals were found which seemed to show some protective ability they were tried out on intact plants. The first results of this work were reported in volume 13 of *Lasca Leaves* in 1963 under the title "Studies on Chemicals to Protect Plants from Smog Damage". More recent work is reported elsewhere in this issue and also in *Lasca Leaves* volume 14, page 74.

Outlook for the Future

Damage to plants from air pollution in the Los Angeles area has been well investigated and the symptoms described. The sources of the materials causing the injury have been determined. Controls have been placed on these sources or are being planned for them, as in the case of automobiles. But to control does not mean to eliminate. Plants are often more sensitive than people, so that an atmosphere which might satisfy the public could still be plant damaging. Investigation should continue along at least three lines.

First, since it has been observed that plants vary considerably in their sensitivity, even in the same species, attempts should be made to develop resistant strains. For example, White Cascade petunia is extremely sensitive while Red Cascade is more resistant. Some of the work being done at the University of California at Riverside should help in this respect.

Second, the search should continue for more satisfactory methods of the protecting plants by means of sprays, dusts or nutrition. Some progress has been reported on this phase now under investigation at the Los Angeles State and County Arboretum.

Third, the removal of some of the pollutants from the atmosphere will affect the overall composition of the smog, therefore, careful observations should be continued by trained observers to be sure that other forms of injurious gases do not occur. This is obvious when one considers that ozone damage has been quite heavy on the tobacco crops in the eastern states and orchid growers in the San Francisco Bay Area have been very seriously affected by ethylene.

In view of these facts and of those contained in other accompanying reports, it is important that all who are concerned with horticulture or agriculture become aware of and maintain an interest in the effects of air pollutants on plant life.



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ARBORETUM INTRODUCTION

Golden Trumpet Tree, *Tabebuia chrysotricha*

Problems of Western Garden Soils

*Lasca
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COVER PICTURE

Golden Trumpet Tree, *Tabebuia chrysotricha*, 1964 Arboretum introduction, is described on page 38 of this issue. Color photograph by Charles Kassler of Pasadena, California.

Problems of Western Garden Soils

ROBERT E. ATKINSON

INTRODUCTION.

The soils of Southern California and the Southwest generally offer special problems not encountered in any other part of the United States. The greatest single difference is the almost complete lack of humus in Southwestern soils because the sparse vegetation of our virtually desert climate has not fostered the accumulation of organic matter in the soil from which humus is made.

Until man began to cultivate land, the soil in areas of sufficient rainfall received an excess of organic matter for centuries. This excess of organic matter decomposed into humus and resulted in the highly fertile soils of the grasslands and forests of the middle West and the Atlantic seaboard. The storehouse of humus in these soils only now is becoming depleted after years of cultivation.

In the Southern states, however, where high soil temperatures prevail during most of the year, continuous bacterial action caused rapid depletion of organic matter. These soils began to lose their natural fertility about the time of the Civil War.

In the Southwest, where the soil never freezes and bacterial activity goes on all year, wherever moisture is provided the little organic matter available is quickly destroyed. Thus, quantities of decomposed organic matter or composted humus must be added to soil that is to become a lawn or garden.

The next greatest difference between soils of the Southwest and the other areas of the country is their reaction (alkalinity or acidity). Western soils are generally alkaline, while the soils of the Midwest, East and South are acid — sometimes too acid for optimum plant growth.

Soil reaction, too, is related to rainfall. Although pure water is neutral in its reaction (neither acid nor alkaline), rain is slightly acid. Falling through the air, it picks up a small amount of carbon dioxide which combines with water to make carbonic acid, a weak organic acid. This is the soil reaction most plants prefer—slightly acid. When rainfall is heavy, soluble alkaline salts are washed out of the soil, leaving the organic acids formed by decaying organic matter to increase, resulting in a soil too acid for favorable yields. Lime must be added to these soils to get the best growth of garden plants.

When rainfall is deficient, as in the West, the alkaline salts increase and often become deleterious. To this already alkaline soil is added irrigation water which also carries a full complement of alkaline salts. These also accumulate in the soil, much as lime builds up in a teakettle, and for the same reason. As water is applied it evaporates, leaving the salts behind. With continual irrigation, the soil quickly becomes too alkaline for optimum plant growth. Soil reaction, too, must be corrected for successful lawns and gardens.

The Importance of Humus

One of the most misused words in the gardener's lexicon is the term "humus". While the casual gardener is liable to consider any organic matter in the soil as humus, the experienced plant grower differentiates between the bulky, raw organic matter such as fresh manure, sawdust and peat moss, and the fine, velvety decomposed organic matter that is true humus.

Any gardener with a compost pit knows the difference, because the bulky leaves, grass clippings, twigs and other raw organic matter put into the compost pile become humus only after months of composting. The great volume of the bulky matter shrinks to less than 10 per cent of its former volume, and the humus — a powdery, brown material — collects at the bottom of the pit.



Large quantities of humus are needed to improve poor soil

There are no short-cuts in making humus because it is a biological process in which the bacteria, fungi and other soil organisms digest the cellulose carbohydrates of the plant remains, use the energy to build the proteins of their own bodies and leave an amorphous chemically stable residue called humus — the very essence of fertile soil.

Of course, the process of decomposition of organic matter into humus goes on in soil as well as in the compost pit. This accounts for the seemingly rapid disappearance of bulky organics after being added to the soil, for they may shrink as much as 90 per cent in the digestive process. Although it does not entirely disappear, a large bag of manure makes less than a double handful of humus. One of the great difficulties of improving soil by adding bulky organics is the fact that nitrogen, required for bacterial growth, is taken out of the soil at the expense of the green plants. The use of composted humus does not cause this nitrogen depletion.

The life in the soil — bacteria, fungi, earthworms — need organic matter for food. It is the bacterial action in the soil that makes available the minerals needed by plants for growth. Without bacteria, all of the organic and ammoniacal nitrogen supplied in fertilizers is unavailable, as is most of the phosphorus and potash. Trace elements in the soil, too, are more readily available when they combine with the organic acids (humic acids) formed in the production of humus. Soil without humus is dead.

Soil Conditioning and Soil Amendments

To understand the need for soil conditioning, we must know more about the nature of soil and how it may sometimes get "out of condition".

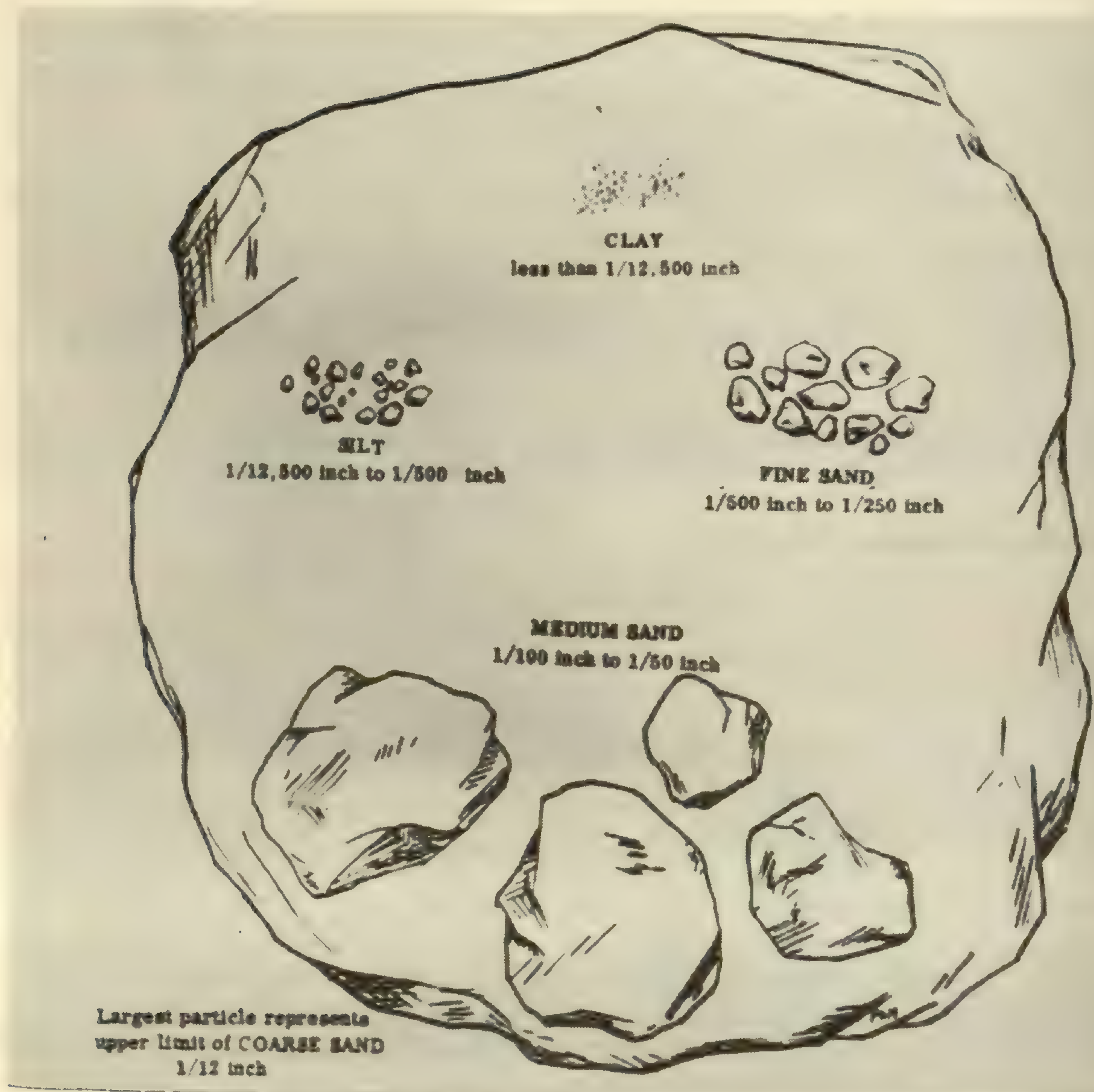
Soil is a mealy material in which plants, by means of their roots, find anchorage, nourishment and water for sustenance and growth. It is composed of disintegrated rocks, organic matter from pre-existing plants and animals, micro-organisms which break down the organic matter, and rock fragments. It also contains air and water which fill the spaces between the soil particles and mineral nutrients dissolved in the soil moisture.

Soil is classified roughly on the basis of the size of its particles: heavy (fine particles) and light (coarse particles). Garden loam, considered the best soil, is composed of sand (about 50 per cent), silt (25 to 40 per cent) and clay (10 to 25 per cent). When soil in a jar is suspended in water, after agitation the sand will settle first, then the silt makes a layer and after standing overnight most of the clay will settle out. By measuring the layers the percentage of sand, silt and clay can easily be determined in this simple test.

When there is 50 per cent silt it is considered a silt loam and up to 40 per cent clay it is a clay loam. The poorest soil is a clay (adobe) which has more than 40 per cent clay particles, a silty clay contains 40 per cent or more of each.

Heavy soils are composed mostly of fine clay and silt. When wet, these fine particles have their air spaces completely filled and have a slippery texture. When dry they are hard and impervious — in fact, they become "set up" like cement.

There are several factors unrelated to the actual structure of the soil and the size of its particles that will cause it to become "out of condition". Foot or vehicular traffic results in compaction. Accumulation of sodium salts causes soil to form a tight, impervious layer below the surface, called caliche. Excessive rotary tilling, cultivation when wet or other bad practices can also be harmful to soil.



Particles of mineral matter in soil. This diagram shows them magnified about 50 times.

One method of conditioning heavy soil is to aggregate the fine particles (combine them into larger particles). The material in nature which binds soil particles together into clumps or aggregates is the residue developed by the decomposition of organic material called humus. This acts like a glue to cause the particles of soil to adhere and gives the soil the texture of rich pie crust. These soils are described as "friable". They have good air- and water-holding capacity and allow plant roots to penetrate easily. Heavy soils can be made into rich, fertile soil by the addition of humus.

Another way to improve heavy soil is by the use of amendments. One would think the addition of sand would be the simplest and easiest way to lighten soil, but this is a false assumption. It requires such huge amounts of sand to have any affect that there is a truism in the trade that goes, "Sand on clay is money thrown away." Copious but practical amounts of organic matter will effectively make heavy soil workable but they should be composed of redwood sawdust, bark or some other material resistant to decomposition (not straw) for lasting effect. On very heavy soils, up to 25 per cent by volume of these organic materials, such as a 3-inch layer over an entire lawn, must be used to properly amend the soil.

To improve light, sandy soil, very often a small amount of clay or silt will produce the desired effect. "Clay on sand is money in the hand." Such soils have large air spaces, are very porous, and water drains away very quickly. To give these soils better water-holding capacity, humus should be added. Other coarse organic materials such as fir bark, sawdust, peat moss and leaf mold are valuable for improving water retention.

When sodium salts in irrigation water have destroyed soil structure, the sodium may be replaced and leached out by the use of gypsum (calcium sulphate). A similar effect is obtained when sulphur is added to soils high in calcium. Although gypsum has no effect on soil reaction (acid-alkaline relationship), soil sulphur tends to counterbalance the alkalinity developed by the accumulation of alkaline salts and makes the soil acid.

Soil Reaction and Plant Growth

Of all the factors which affect plant growth, perhaps the most insidious is soil reaction. There is no warning when the alkalinity becomes excessive except the poor plant growth, the fading of vivid flower colors and fragrance, reduced yield of flowers and fruit. This decline is often so gradual as to escape detection. The symptoms, of course, are similar to the effects of soil depletion, and fertilizer application is the first remedy that suggests itself. Unfavorable soil reaction is clearly demonstrated as the most probable cause when fertilizers produce no appreciable change in plant appearance.

This problem has become increasingly common in the fields and gardens of the West, with the continual accumulation in the soil of the alkaline salts found in the irrigation water. When water evaporates it leaves behind its total salt content. Only heavy, "over" irrigation or heavy rainfall will carry these salts away. Light rains and normal irrigation merely carry the salts down to the root zone where they create a serious hazard to plant growth. This problem is acute — indeed, the limits of tolerance of many plants already have been reached.

All acid-loving plants are the first to show distress from alkalinity. Azaleas, gardenias, hydrangea turn yellow — first the lower leaves, then as the trouble worsens, the entire plant. In desert areas, alkaline salts (white alkali) can be seen as a frosty deposit on soil and clay pots and on rocks and cement walks in the garden paths. More damaging, however, is the black alkali that cannot be seen. Here is a simple test for black alkali. To a spoonful of black soil in a water glass, add several drops of hydrochloric acid. If it bubbles, the soil contains the dread black alkali.

The best indication of soil reaction, however, is the pH. In order to measure acidity and alkalinity, a scale from 1 to 14 has been established, based on the reaction of water which is neutral (neither acid nor alkaline) and is at the mid-point of 7. Higher than 7 pH is alkaline, below is acid. This is more easily understood if one considers the chemical formula of water, H_2O , but written HOH . Acidity is related to the excess of hydrogen (H), and alkalinity to the preponderance of hydroxyl (OH). Water (HOH) has an equal number and is neutral. Rain water is 6.5. Most plants and soil bacteria are adapted to the reaction of rain water and prefer slightly acid soil.

For ease in remembering, compare the pH with the temperature (Fahrenheit) scale, but space off the last digit. (Fig. 4) A room temperature of 70 degrees is optimum for man, while plants in general prefer a slightly cooler 65 degrees. Man's blood has a pH of 7.3,

plants prefer soil solution of 6.5. Just as many plants grow best at 50 to 60 degrees, some plants (acid-loving) grow best at a soil pH from 5 to 6. Although some plants prefer temperatures of 80 to 90 degrees, there are no plants that prefer high pH. Several will tolerate and some, such as bermuda grass, thrive better at high pH, but it is because of lack of competition. No ornamental plants have become adapted to alkaline soil, perhaps because all plants were dependent on rain for water until the rather recent (in plant history) innovation of irrigation.

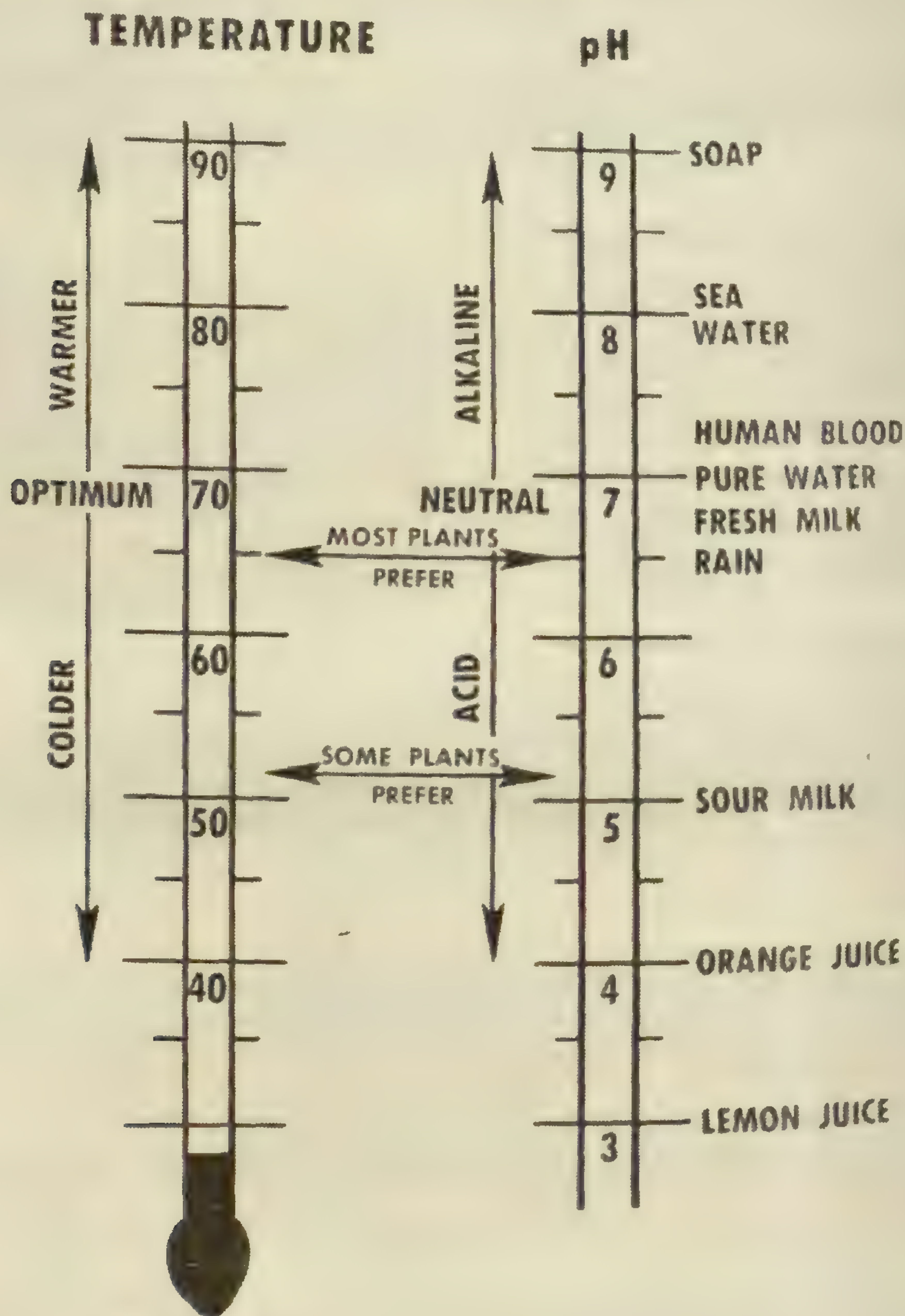


Fig. 4 — pH SCALE COMPARED WITH TEMPERATURE SCALE.

Unlike the temperature scale which progresses arithmetically and 80 degrees is 10 degrees warmer than 70 degrees and 90 degrees is 20 degrees warmer than 70 degrees, the pH scale progresses geometrically and a pH of 8 is 10 times as alkaline as a pH of 7 and a pH of 9 is 100 times as alkaline as a pH of 7.

Fortunately, the effect of alkaline salts can be minimized by the humus in the soil and actually counteracted by the acids produced by bacteria in the decomposition of organic matter. The end-product renders these salts harmless by a buffering action in which the salts are adsorbed by the colloids. The organic content of the soil, therefore, plays a dual role in reducing plant damage from alkalinity.

This accounts in part for the great variation in the damage. Soil reactions may vary from one lawn to the next or even between different locations in the same garden. Sometimes this is due to other factors besides amount of humus. In the Southwest a new sidewalk, through leaching of the lime into nearby soil, may make adjacent soil too alkaline for dichondra or bent grass. Foundations frequently serve as a continuing source of lime for many years and this affects foundation plantings adversely. Many new-home owners have been able to locate buried plaster from the reaction of plants and soil to excessive alkalinity created by the lime.

The reaction of plants to alkalinity (or acidity) is due to the effect of pH on the availability of minerals. The chart (Fig. 5) illustrates the high solubility of all necessary minerals at a pH of 6.5 to 7 and the diminishing solubility at either end of the scale. It shows that nitrogen and potash become insoluble at a pH of 8. This is due to the inactivity at a high pH of the bacteria that render these minerals available to plants. Phosphorus, on the other hand, combines chemically with calcium at a high pH and becomes insoluble. Only by bacterial action can the phosphorus be released for plant use. Iron and manganese quickly become unavailable when the pH is above 7, as do copper and zinc.

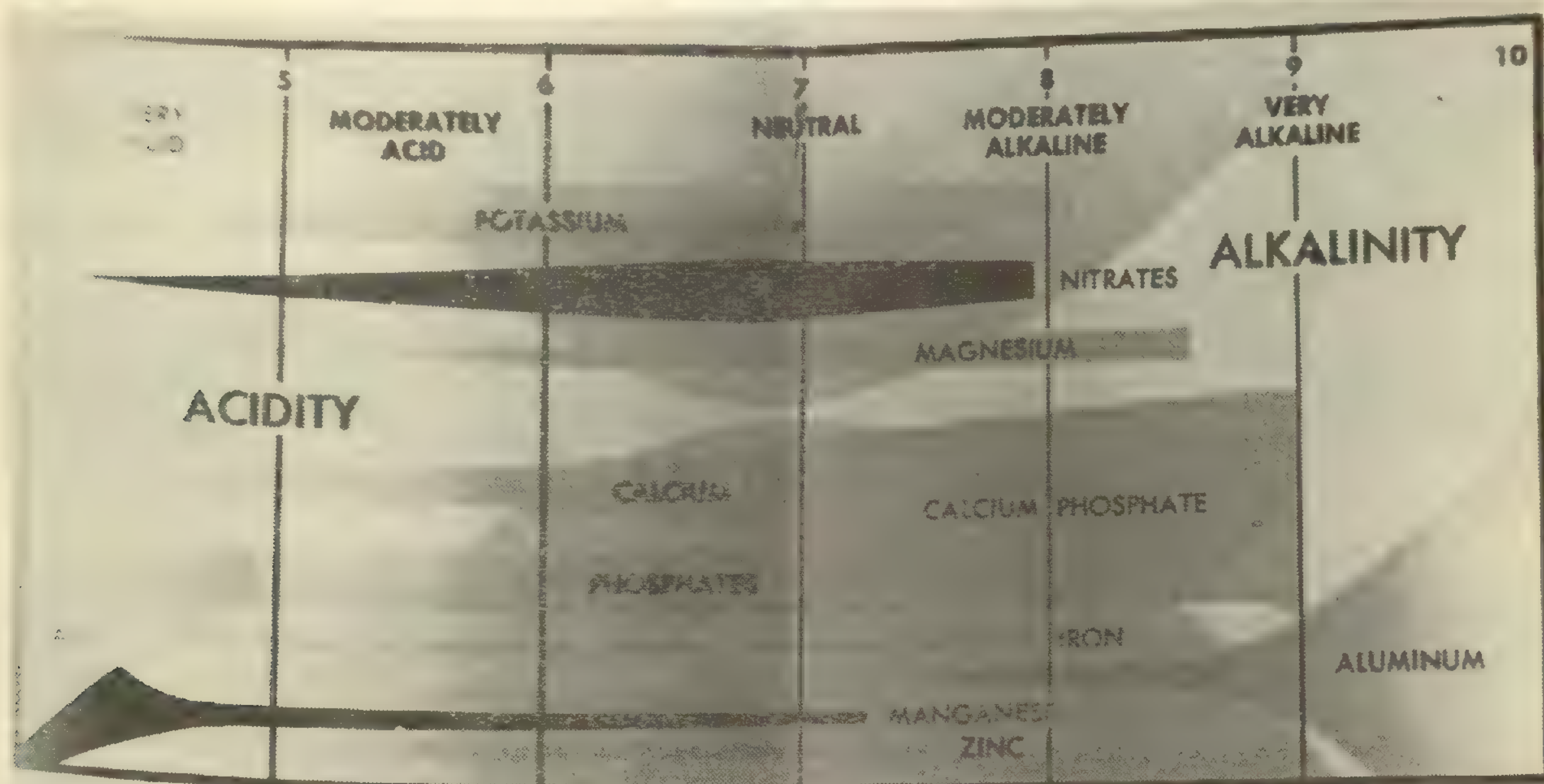


Fig. 5 — A chart showing the relation of soil reaction to the availability of nutrients to plants.

The effect of unfavorable soil reaction can be treated by the application of excess amounts of the trace elements bound up by the high or low pH. Although this amounts to treating the symptoms rather than the cause, it is very desirable to quickly alleviate the symptoms. On the chance that one or more of the elements is lacking, it is wise to supply all of the possible deficiencies. Of course it is best to use as a standard practice fertilizers which contain all of the essential trace minerals. In an emergency, the trace minerals can be supplied through the foliage by spraying the plants with a solution of trace minerals.

The basic problem of soil reaction is not affected by these superficial measures. It is only by the application of lime if the pH is low or sulphur in some form if the pH is too high, that soil reaction is permanently corrected. Because soil sulphur is inexpensive and releases acid over a long period of time, this material is generally favored. It has a rather limited use, however, because it must be mixed thoroughly with the soil to be effective. It is best used, therefore, only at planting time, and if the alkalinity problem appears subsequent to planting, soil sulphur is not the answer. Furthermore, its slowness of action is a drawback, as it requires at least a year to become effective.

Gypsum is used by many who believe they are counteracting alkalinity, but they are not. The main benefit of gypsum is to replace the sodium on colloidal clay particles which makes clay hard and impervious to water. The sodium salts formed are soluble and can be leached away. The calcium in gypsum opens up hard clay soils and improves drainage, allowing the alkaline salts which have accumulated to drain away.

Aluminum sulfate and iron sulfate have been used rather extensively and with varied results. Their effect on alkalinity is slight and not permanent, but with soluble materials it is very difficult to change the soil pH and the materials should be applied every year for best results.

One of the soluble materials that overcomes many problems in alkaline soil is lime sulphur. This is effective in reducing alkalinity and in replacing excessive sodium in the soil. Apply one gallon per 1000 sq. ft. of lawn or one cup over a 5 x 10 foot flower bed. Water it in thoroughly. A quick change in the soil reaction may release minerals and produce the same effect as a heavy fertilization.

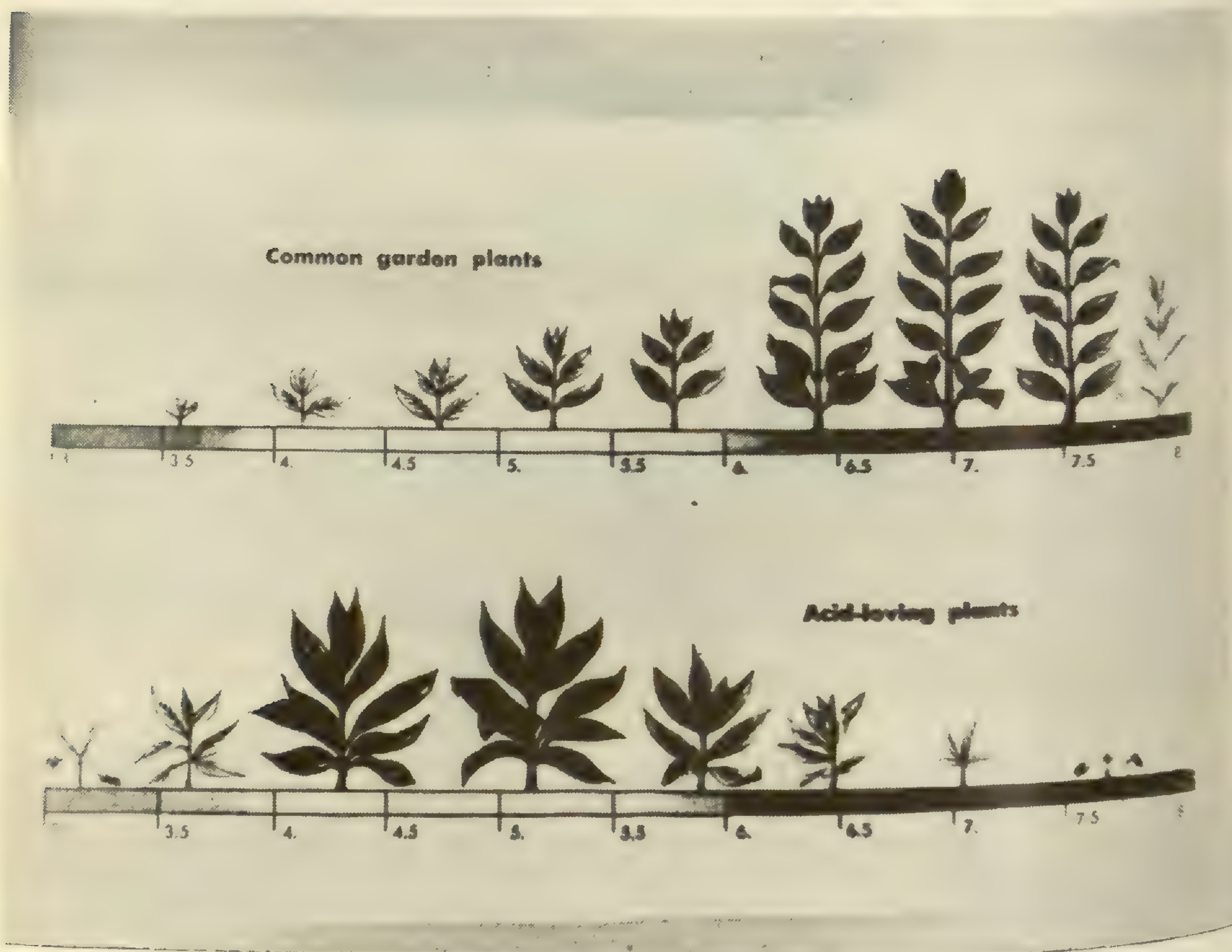


Illustration of effect of pH on growth of acid-loving plants compared to ordinary plants.

Minerals

Besides the carbon dioxide and oxygen in the air and water, plants require certain minerals for healthy growth. The essential elements are contained in the old saw: "C. Hopkins Cafe". When magnesium was found to be needed, the comment, "mighty good", was added because the first letters (mg.) stand for magnesium. The elements are carbon (in the air), hydrogen and oxygen (present in water), phosphorus, potash (K), iodine, nitrogen, sulphur, calcium and iron (Fe). Iodine has since been found to be non-essential, while copper, zinc, manganese, boron and molybdenum are essential to plant growth.

To convey an idea of the relative amounts of each mineral needed, Table (1) shows the requirements of one acre of grass.

Note that the element needed in greatest amounts is nitrogen and this is the element most apt to be deficient in the soils of the Southwest. Nitrogen, phosphorus and potash are the major elements provided by fertilizer and are listed in this order in the formula of every fertilizer. Calcium, sulphur and magnesium are usually present in sufficient quantities in Western soil and are called the minor elements. Iron, zinc, manganese, boron and copper are needed in such small amounts they are called "trace" elements.

MAJOR ELEMENTS

NITROGEN

Nitrogen gives dark green color to plants. Rapid growth of all plants is induced and protein content of plants is increased. Excess nitrogen should be given when heavy applications of raw organics are mixed in soil.

Nitrogen is the one element that almost always is deficient in Western soils and is the one most often applied. The value of a fertilizer is usually rated first by the amount of nitrogen contained. By law, the nitrogen content must be named first in the fertilizer formula.

Nitrogen in its pure state is a colorless, odorless, inert gas that constitutes about 80 per cent of our atmosphere. The 35,000 tons of nitrogen in the air over every acre of land is unavailable to all plants except a few bacteria species. Plants can use nitrogen only when it is properly combined with oxygen or hydrogen in nitrate (NO_3) and ammoniac (NH_3) form.

Fertilizers are classified into two kinds on the basis of the source of nitrogen: chemical and organic. Chemical forms of nitrogen are also two: ammoniac and nitrate. Formerly it was believed that plants absorbed only nitrate nitrogen. Then the acid-loving plants were shown to use ammoniacal and now almost all plants are known to be able to absorb the ammoniac form directly. When bacterial activity is great, ammoniac is quickly converted to nitrate nitrogen in the soil.

The most common source of ammoniacal nitrogen is sulphate of ammonia which is 21 per cent nitrogen and has the formula 21-0-0. It has two distinct advantages: (1) it is not readily leached and (2) it tends to acidify the soil. The first is also a disadvantage in that this form of nitrogen tends to be fixed (unavailable) in the surface layers when applied to soil and does not penetrate down to deeper-rooted plants. Occasionally it is found that long repeated use of sulphate of ammonia has made the soil too acid.

Nitrate nitrogen is sold as ammonium nitrate (34-0-0) which has both forms of nitrogen, and as calcium nitrate (15-0-0). The latter is beneficial on soils lacking lime, on those which contain excess sodium and on acid soils. Chilean nitrate (nitrate of soda) never should be used in the Southwest because the soil and water already contain too much sodium.

Organic nitrogen is principally from cattle manures which contain .5 to 1.5 per cent nitrogen, blood meal (13-0-0), fish meal (10-5-0), sewage sludge (1 to 5 per cent nitrogen) and castor bean meal (6-3-1). Poultry manure may contain up to 5 per cent nitrogen. Organic sources are preferred in the garden because the nitrogen in organic materials is fixed (insoluble) and only released by bacterial activity. Thus organic nitrogen can be used carelessly without great danger of "burning".

The long-lasting results and the bonus of soil-conditioning value that organics give often make them desirable in spite of their higher price per unit of nitrogen.

PHOSPHORUS

Phosphorus, intimately associated with all life processes, is a vital constituent of every living cell. The phosphate content of a fertilizer is always the second number in a fertilizer formula. Its stimulation of early root formation results in a rapid and vigorous start for plants.

The best time to apply phosphorus to the soil is at planting time, for placement is the most critical factor in its use by the plant. Even on sandy soil it is difficult to get phosphorus to penetrate more than a couple of inches. Water applications of phosphorus do not give as good results as placing the fertilizer in the planting hole. A five-year supply may be applied at planting time.

The native phosphorus in soils is "bound" or "fixed" in unavailable forms. In the acid soils of the East, one of the principal benefits of lime application is the release of phosphorus. When the pH of the soil rises to 8 or 8.3, as occurs in the alkaline Western soils, the availability of soil phosphorus is also markedly lowered.

Strangely, application of phosphate, guaranteed on the label as phosphoric acid, does not make the soil more acid, but leaves a residual alkalinity. So-called "acid food" which contains a high content of phosphorus has the opposite effect on soil from the desired, making it more alkaline.

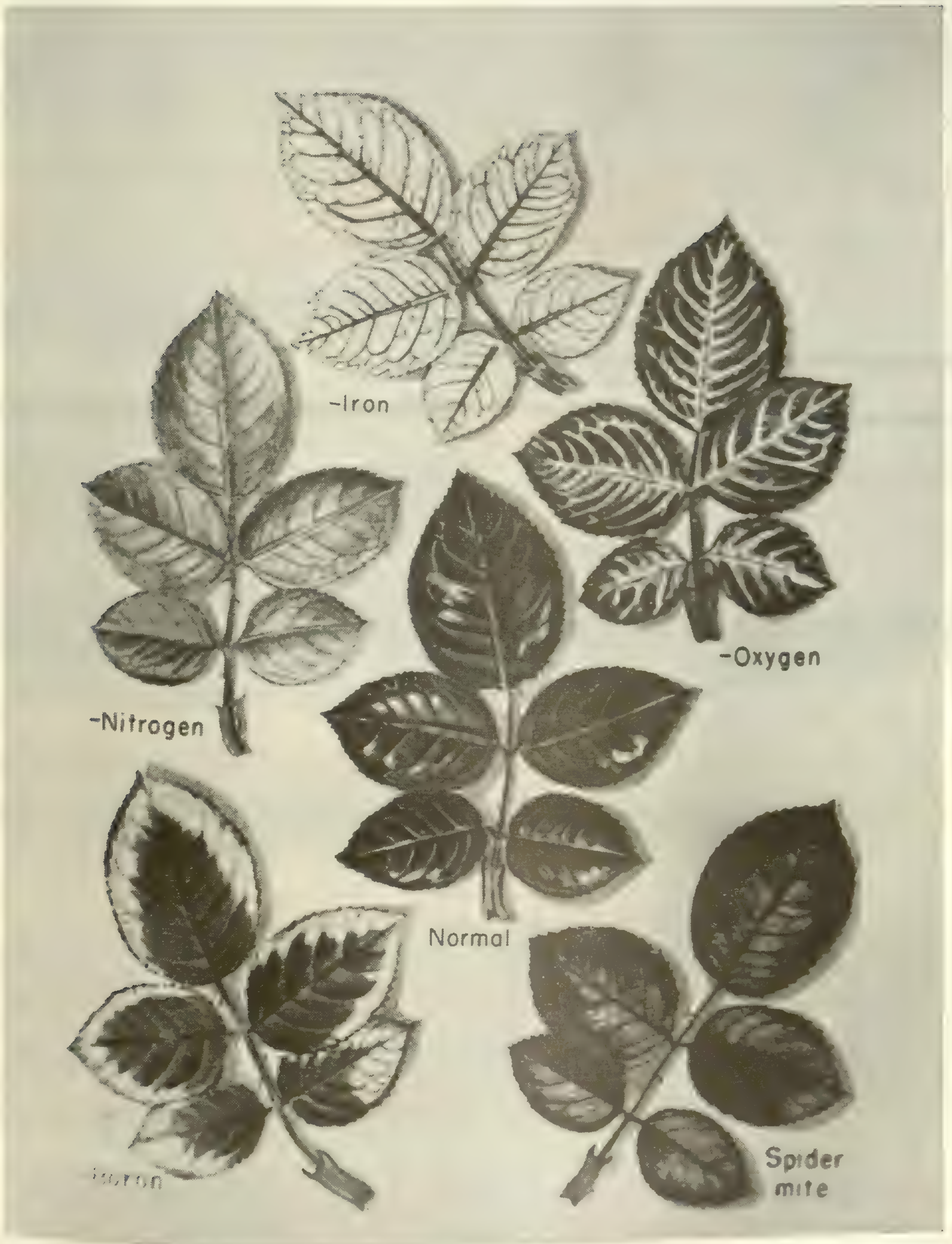
Application of a good acidifier releases natural phosphorus in alkaline soils and is the easiest way to supply phosphorus to established plants. Available phosphorus is supplied by super-phosphate in chemical and by bone meal and sewage sludge in organic form.

Problems occur from over-fertilizing with phosphorus. Because it does not leach out, it will accumulate from year to year and can affect the availability of essential trace elements. As little as 300 pounds of superphosphate an acre has induced serious deficiency of zinc and copper in citrus and undoubtedly other plants are affected also. Probably the availability of iron and manganese is also adversely affected. Home gardeners who dutifully use a high phosphate "acid food" may be creating a doubly serious lack of minerals by increasing alkalinity and by phosphate fixation of the necessary trace minerals.

POTASH

In spite of the fact that California soils are far richer in potash than any other essential element, potash application is next to nitrogen in importance. Most soils have 40,000 pounds of potash per acre in the uppermost foot of topsoil. Very little of the natural supply of potash is available to plants and they require far more of this element than any other except nitrogen.

The importance of availability can be illustrated by a man with only one dollar in his pocket leaning against a bank vault containing a million dollars. There is plenty of money in his general vicinity but only one dollar is available. Increasing the solubility of natural potash reserves is accomplished only by bacterial action. In Western soils, low in the organic matter which serves as food for soil bacteria, the vast supplies of potash are locked up and



A comparison of the effect of mineral deficiency and spider mite injury to rose leaves.

must be supplied in fertilizer.

Potash content of a fertilizer is the third and last figure given in the fertilizer formula. Unlike nitrogen and phosphorus, the first two major elements, potash does not enter into the composition of any chemical compounds in the plant. Nevertheless it is vital to all life processes, being especially influential in the formation of flowers and the maturation of seeds and fruit. Sturdiness of stem and strength of stalks are also imparted by potash.

Usefulness of the chemical is attested by the fact that often 50 per cent of the ash of living plants is potash. The necessary level of the chemical in living leaves is from one to 3 per cent. When the amount of potash falls below one per cent, leaves become scorched at the margin and trees develop die-back of twigs and branches. An upward rolling of leaves is characteristic of potash deficient peaches and apricots. Excessive leaf shedding, flowers dropping at blossom time, as well as eventual dieback, is evidence of potash deficiency in citrus. Perhaps the most common cause of reduction in fruit size of oranges is potash lack.

In its pure state potassium is highly reactive and dangerous to handle. In fertilizer, potash is supplied in the sulphate and muriate (chloride) forms. The former is of greater value because it is utilized better by plants. The chloride form also contributes to the greater salinity of Western soil and water and is less desirable also from this standpoint.

Wood ashes is rich in potash — in fact, the word is derived from the primitive method of making lye from wood ashes in pots. The ash that remained in the container, "potash", was a valued fertilizer in ancient times.

Not only the quantity of fruit and vegetables produced, but the quality as well, is affected by potash. The effect of potash on the formation of sugars, starches, soils and proteins, while not fully understood, is exceedingly great. This not only translates into higher quality of vegetables but greater aroma and flavor of herbs. Of greater importance to gardeners is the fact that flower color may be deepened and fragrance enhanced with heavy applications of potash. This is especially true with roses.

TABLE 1.

ELEMENTS REQUIRED FOR ONE ACRE OF GRASS.

ELEMENT	AMOUNT NEEDED	SOURCE
Water	4 to 5 million lbs.	19 to 24 inches of rain
Carbon dioxide	19,000 lbs.	4 tons carbon
Oxygen	6,800 lbs.	34,000 lbs. air
Nitrogen	160 lbs.	800 lbs. sulfate of ammonia
Phosphorus	40 lbs.	458 lbs. superphosphate
Potassium	125 lbs.	251 lbs. potassium chloride
Calcium	50 lbs.	200 lbs. limestone
Sulphur	75 lbs.	75 lbs. sulphur
Magnesium	50 lbs.	250 lbs. epsom salts
Iron	2 lbs.	10 lbs. iron sulphate
Manganese	5 oz.	1 lb. manganese
Boron	1/10 oz.	8 oz. borax
Zinc	1/10 oz.	pinch of zinc sulphate
Copper	1/10 oz.	pinch of copper sulphate



Tabebuia chrysotricha (Mart.) Standl.

An evergreen* open tree to 30 ft.

Leaves compound, palmate, 7 to 10 in. wide, opposite, petioled. Leaflets usually 5, oblong-ovate, entire, 1½ to 2 in. wide, glabrous and dark green above, pubescent and lighter beneath (rusty-tomentose when young), somewhat coriaceous when mature.

Flowers yellow, 2½ to 3 in. across, short-pedicelled, in many-flowered dense-clustered inflorescences appearing in late March through early May.

Fruits cylindrical, to 9 in. long and 1/3 in. in diameter, pendent, generally singly, densely tomentose, ripening in 4 to 6 weeks.

*Except while flowering.

Tabebuia chrysotricha

ARBORETUM INTRODUCTION — 1964

Common Name	:	Golden Trumpet Tree
Generic Name	:	<i>Tabebuia chrysotricha</i>
Family	:	Bignoniaceae
Origin	:	Brazil
Form	:	Small tree, spreading in habit to approximately 30' in height.
Flowers	:	Bright yellow trumpet shaped flowers in large and profuse clusters.
Foliage	:	Dark green and somewhat shiny on top with prominent veins. Leaflets vary in size from 2 to 4 inches.
Growth Rate	:	Tree will grow rapidly, 4 to 5 feet per year, if headed back to a single leader and staked. If not headed back, plant will develop into a shrub.
Soil Requirement	:	Does not appear to be choosy of soil types as tree has grown equally well in heavy and light soils.
Exposure	:	Best in full sun.
Temperature Tolerance	:	23°-110° F
Water Needs	:	Performs best with a plentiful supply of water.
Pruning	:	Heading back to single leader when small to form a tree, and occasionally thereafter for shaping.
Propagation	:	Mature trees will seed profusely. Seed must be planted within a month to insure good germination.
Remarks	:	Seed of this small but sensational tree was first obtained in 1957 and the first flowers appeared in 1961. When grown under optimum conditions, tree will flower within three years and should reach a height of 10 to 12 feet during this time. As the tree matures several clusters of flowers will appear on long branches with as many as 30 blooms to a cluster, normally in April for approximately three weeks.

MINOR ELEMENTS

Compared with the major plant food elements, nitrogen phosphorus and potash, the minor elements, calcium, sulphur and magnesium, are needed in very small amounts. For example, 2 pounds of lime, 6 pounds of sulphur and 4 pounds of magnesium are used by a whole acre of apple trees in the production of 300 bushels of fruit. This is a mere fraction of an ounce per tree.

CALCIUM

Calcium (lime) is present in most Western soils, either derived from the natural rock, limestone, or from the hard irrigation water. Some agricultural soils contain up to 30 per cent calcium carbonate. Limestone soils are traditionally fertile, especially favored are clovers, blue grass and alfalfa. Soils which do not contain calcium are benefited by application of limestone if they tend to be acid and by gypsum if they are neutral. A good test for lime is to treat soil with sulphuric acid. A drop or two is sufficient. If bubbles appear, do not add lime.

Most calcium in plants is found in the substance which binds cells together. Root and shoot growth, vigor and sturdiness are affected by calcium lack.

SULPHUR

Sulphur is present in soil in two forms: (1) chemically combined as sulphate and (2) elemental or free sulphur. As a constituent of the amino acid, cystine, it exerts a powerful influence on protein formation. Because proteins are the basic materials of protoplasm, all growth stops in the absence of sulphur. Plants can utilize either form and sulphur deficiency is very rare, as many natural occurring elements are in the sulphate form.

Elemental sulphur is important mainly in the correction of soil alkalinity and is widely used for this purpose throughout the West. When sulphur oxidizes and combines with water it forms a weak acid. Although some oxidation occurs in sterile soil, the greatest activation is through the action of bacteria.

In soils which contain adequate lime, the end product of the sulphur reaction is calcium sulphate, or gypsum. It is far better to form gypsum in this way than to apply it to soils already high in calcium, because a bonus of alkalinity correction is obtained.

Metropolitan and Colorado River waters which poison soil with their high sodium content are often best counteracted with dolomite, or gypsum, but to return Western soils to their maximum production, acidification is essential.

Lime sulphur, also used for acidification, contains elemental sulphur in its finest state, almost in true solution. It is an excellent form for the use of counteracting alkalinity in soils around established plants.

MAGNESIUM

A common constituent of Western soils and rarely lacking in nature, magnesium is the keystone of the chlorophyll molecule and plays several important roles in the plant's physiology. It aids in transformation of starch and is thought to be important in the formation of fats and oils. Magnesium may be related to the absorption and translocation of phosphorus and affects the earliness and uniformity of vegetable crops. The size of yield and quality is seriously reduced with magnesium deficiency. Plants lack characteristic green color and usually the lower leaves are affected first. Tomatoes grown in a magnesium-deficient solution have very brittle leaves with areas of dead tissue.

Epsom salts (magnesium sulphate) is used to correct this deficiency. Dolomitic limestone (dolomite) which contains both calcium and magnesium, is a fine soil amendment for highly organic garden soils in which one or both of these elements may be lacking. Dolomite is especially good for correcting acidity because it will not create alkalinity if applied in too great amounts.

LASCA LEAVES

TRACE ELEMENTS

Although Western soils are rich in the minerals required by plants in trace amounts, symptoms of zinc, iron, manganese, copper and boron deficiencies are widespread in many shade trees and ornamental plants and also in vegetable crops.

Zinc.

Zinc was a limiting factor in the citrus growing in California until it came into general use as a foliage spray. Its use is equally important on avocado. Zinc is the most widespread of the trace element deficiencies of deciduous fruit trees. When leaves contain less than 10 parts per million of zinc they have the mottled pattern characteristic of this trouble.

Iron.

Iron deficiency is common in California but is more difficult to correct and thus causes most damage of any single element lack. Soil application of iron combined with organic acids called chelates has been the quickest corrective. Acidifying the soil has been the most promising permanent control. Liquidamber, oak, gardenia, azalea and magnolia have responded to soil treatment with iron sulphate.

Manganese.

Plants suffering lack of either iron or manganese produce leaves with yellowing between the veins and all green drained out except that adjacent to the vein. Manganese deficiency is easily rectified with a spray and manganese is included in the standard zinc spray on citrus. A single treatment will supply enough manganese for an entire season's growth.

Copper.

The citrus disease known as dieback (exanthema) is caused by lack of copper but it can be supplied easily in sprays. General use of copper fungicides has prevented copper deficiency symptoms in many plants in the past. Now with non-copper fungicides coming into general use, more deficiencies have appeared.

Boron.

Stem cracking in celery is caused by lack of boron, but because some irrigation waters contain too much boron, it is possible to have symptoms of deficiency of this element adjacent to poisoning caused by excess boron.



Symptoms of manganese deficiency in lemon leaves. Leaf at left shows mild symptoms getting progressively more acute toward the right.

(Courtesy California Agricultural Experiment Station)



(Courtesy California Agricultural Experiment Station)

Mottled citrus leaves due to zinc deficiency.

Grading and the Use of Top Soil

The first problem encountered on the site of a new home is that of grading. Before you make any extensive change in the terrain, consider what the natural flow of rolling ground does to add interest to your site. Many have allowed the bulldozers to flatten a landscape, only to call back the earth movers to attempt to restore the natural effects that were so quickly destroyed.

The contractor usually is required to bring the lawn to rough grade, but some interpret this as very rough indeed. Sometimes it is a blessing, for in very heavy soil or soils with an impervious layer, a subsoil grade should be established first. Such subsoil needs to be graded so that water is not trapped but runs off, drained by gravity. If a satisfactory slope cannot be established, it may be necessary to install tile drains.

The first requirement for drainage lines is to find a suitable outlet of sufficient depth. It may be the storm sewer or the city street. If you are in a pocket with no natural outlet, the best method is to provide a sump by digging a dry well and filling it with rock and gravel. The minimum effective fall is 3 inches in 100 feet and the tile should be placed 18 inches to 2 feet deep with lines about 20 feet apart. The main line should be of 6- or 8-inch tile and the feeder lines set in a herring bone pattern should be 4 inches. The lines should angle with the flow of water. Either clay or cement tile should be set with $\frac{1}{4}$ inch openings between to permit the easy access of water. Lateral lines should be filled with 6 inches of gravel or crushed rock before the trenches are backfilled. This keeps the tile free of filling with silt and mud.

Never grade the surface level — you do not want a perfectly level lawn. A slope of 6 inches in 100 feet is best; the maximum slope for grass is 1 foot in 10 feet. The final grade is fixed by the house foundation, the sidewalk, or by the existing level around valuable trees. Inexpensive string line levels are indispensable for establishing the grade. Stretch a cord, and using the levels, mark stakes at the point to which cut or fill is required. For a small area, a shovel and wheelbarrow are enough equipment to remove high spots and fill in low areas. The lawn should slope away from the house.

If the grade change is abrupt — 25 per cent or more — it may be held best with ground covers. Another solution is to terrace it with redwood boards, logs or lengths of asbestos cement. A slope held by a dry wall is always preferable to a high retaining wall. Because water is the basic problem encountered in controlling a steep slope, the retaining wall should be thought of as a dam that may be required to hold water at pressures corresponding to its height. Any wall higher than 3 feet is an engineering feat and should be built only with professional help.

A dry wall is simple and effective and easily accomplished by a home gardener. Such a wall has open joints which prevent water pressure from building up. Rough stones, cement blocks laid edgewise with their open ends out, or a lattice of logs or railroad ties are ideal solutions.

USE OF TOPSOIL.

When the grade is lower than it should be or where the existing soil is absolutely unamendable—then, and only then, should the use of topsoil be considered. Any soil that differs greatly in structure or texture from the original soil will only create problems when it is used as topsoil.



Work soil to 6" or 8" depth with power tiller, or spade deeply.

If the subsoil has been compacted, either by machine or by foot or vehicular traffic, it must be broken up before the topsoil is brought in. To prevent the development of an "interface" or zone that is impervious to water or roots, thoroughly mix the topsoil with the existing soil. Twelve cubic feet of topsoil will cover 100 square feet to a depth of 4 inches. A 4-inch layer will settle about an inch to make an actual 3-inch addition.

Whenever possible it is always cheaper and usually much more satisfactory to improve existing soil by adding large quantities of digested sludge or composted manure than to bring in topsoil. The importance of humus to soil cannot be over-emphasized. Any soil can be made rich by the addition of sufficient humus.

Planting and Fertilization of Garden Plants

LAWNS

After the area is brought to grade with the proper slope, the soil may be treated with a soil sterilant before planting. There are several products that may be used to kill weeds and weed seeds before planting a lawn. One is calcium cyanamid which is applied with a fertilizer spreader according to directions. Wait three weeks before planting. Soil sterilants cannot be applied near shrubs nor under the branches or adjacent to shallow-rooted trees. Other soil sterilants are liquids which vaporize in the soil, such as vapam, methyl bromide and chloropicrin (tear gas).



Smooth surface of lawn with plank or leveler before sowing seed.

You may apply digested sludge as a fertilizer and soil conditioner, for it contains no weed seeds to contaminate the area. If you are going to plant cool season grasses, a soil acidifier such as soil sulphur may be needed. One pound to 100 square feet is sufficient. Rototill the humus and sulphur and level the ground. The soil should be dragged with a flat plank as many times as is necessary to get a smooth, even surface.

Then sow seed, either by broadcasting or with a spreader. If you broadcast seed, choose a calm day and divide the seed in two equal parts. Sow half while walking in one direction and the other half walking across the first (at right angles). A wire broom or rake pulled lightly over the surface will lodge and cover the seed. Water lightly and apply a light coat of mulch to prevent the death by drying of the seedlings. Roll with a roller (rented) to firm the seed bed. Remember to pull the roller rather than push it and you'll leave no footprints in the new lawn. The surface of the soil must be kept continuously moist to get good germination.



After seed is sown roll it to firm seed into seed bed.

When the grass has emerged the daily watering may be reduced to once or twice a week and eventually a regular interval should be established for irrigations. In summer, water cool-season grasses once a week. Apply a lawn fertilizer to cool-season grasses (blue grass, bentgrass and fescues) once a month.

GROUND COVERS

Follow the same methods for soil preparation used for lawns except it is necessary to prepare the soil only in the immediate planting area when planting ground covers at some distance from each other, such as ivy. Fertilize when established.

FLOWER BEDS

Deep spading of flower beds, using large quantities of humus, will pay off handsomely in larger plants and longer-lasting flowers. If you are planting in an established flower bed, dig in a double handful of humus below every plant you set out. Fertilize once a month.

TREES AND SHRUBS

Dig holes for trees or shrubs twice the size of the container. Thus, for gallon size plants, a two-gallon hole would be dug, or a plant in a 5-gallon container needs a hole of 10 gallon volume.

A good test for drainage is to fill holes with water. If water stands overnight in the holes, drainage must be improved or the plants will die. Sometimes outlets filled with gravel can be provided that drain to the street or a lower lawn level. Usually drainage to a sump is unsatisfactory in the long run and a better solution is to plant in raised beds or on a mound of soil.

If the soil is excessively alkaline or if you are planting acid-loving plants, correct the reaction by applying soil sulphur in the bottom of the hole. Blend the soil from the hole with humus and refill around the roots, letting water run into the hole as the filling continues. If large amounts of water are not available, trample the soil firmly around the plant roots.

Always plant slightly higher than the soil level of the plant in the can to allow for settling. If the plant is set deeper it will usually die. Construct a basin around the base of the plant to facilitate watering. Mulch to protect against water loss and prevent weed growth. Stake the plant if necessary.

After the plants are established, fertilize at least four times a year.

Watering and Mulching

Here in Southern California no area gets sufficient rain to maintain a garden; hence planning the irrigation is one of the most important aspects of gardening. The type of soil, kinds and maturity of plants, the temperature, humidity and the season — all have a profound effect. Degree of slope, amount of humus in the soil, the use of mulch, as well as the amount and pressure of the water must also be taken into account. There is no royal road — no rule of thumb — to cover all variables.

Heavy soils (clay or adobe) hold about three times as much water as light (sandy) soil. Medium soils (loam) are somewhere between these extremes. Rate of penetration of water is about three times as fast in sandy as it is in clay soil. Thus water takes 25 minutes to



Mulch is essential to prevent drying out of young seedlings or newly seeded areas.

penetrate to two feet in light soil, about 40 minutes in loam and 75 minutes in heavy clay. On the other hand, clay will hold three times as much water and will need to be replenished roughly one third as often. The following table gives the average interval in days between watering on different kinds of soil:

	6 inches	12 inches	2 feet
Sandy	3 to 5 days	5 to 10 days	10 to 12 days
Loam	6 to 10 days	10 to 15 days	15 to 20 days
Clay	10 to 15 days	20 to 30 days	30 days

Grass lawns require water penetration to 12 inches, perennials and low shrubs about two feet, large shrubs and trees to a depth of three to five feet.

In summer, plants can use 5 times as much water as they do in winter. This is due to higher temperatures and lower humidity, but it is also caused by increased growth and the more tender leaves. But watering cannot be eliminated in winter without injury to plants. Do not be deceived by cool temperatures and high humidity into neglecting to water. Be sure plants have sufficient water in their root zone. One way to test for sufficient water is to use a soil probe, a small steel rod that will penetrate with even pressure in wet soil but will resist when dry soil is encountered.

In periods of extremely low humidity when dry desert winds blow, the frequency of watering must be increased to compensate for water loss by evaporation. During these periods it is well to spray the leaves of plants to increase the humidity and provide water to the cells of leaves directly.

On steep slopes, slower watering for a longer time is preferable to prevent excess runoff. Developments of basins and terraces, where practical, are ways to supply water to plants on slopes. The use of canvas soakers is another way to provide water without loss.

Where the amount of water is limited, it is best to plant only drought-resistant plants such as native plants, succulents and the many plants in the trade adapted to a Mediterranean climate.

Humus added to light or medium-textured soils increases the water-holding capacity and decreases the amount and frequency of water applications needed.

MULCHING

The most neglected aspect of gardening in this desert area is the failure to use mulches. Mulch conserves soil moisture, lowers surface temperature and provides gentle feeding of shallow roots. It also increases bacterial activity and thus makes more nutrients available. It counteracts the excessive alkalinity of irrigation water and prevents erosion by wind or water.

A mulch is essential to protect young seedlings and if applied thick enough can discourage weed growth. Lawns, especially dichondra, should be dressed with mulch at least once a year. The best time to apply it is in March or April, although Bermuda grass lawns are often greened up in February by a light dressing.

Fruit trees, such as avocados and citrus, respond to mulch by producing larger crops, and the fruits are held on better. Azaleas, camellias and other shallow-rooted plants must be mulched because plants are set back severely when the feeder roots are damaged by drought. Most shrubs and foundation plants present handsome foliage when they are heavily mulched.

Shade trees respond best when a method called vertical mulching is used. Holes 2 inches in diameter are bored on one-foot centers at the base of the tree from within 2 feet of the trunk out to the dripline. These holes are filled with mulch or humus to facilitate deep watering and to provide mild nutrition.



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ARBORETUM RE-INTRODUCTION
Floss Silk Tree, *Chorisia speciosa*

Lasca Leaves

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COVER PICTURE

Floss Silk tree, *Chorisia speciosa*, an Arboretum re-introduction, is described on page 60 of this issue. Color photography by Charles Kassler of Pasadena, California.

*Japanese Gardens
in the
Los Angeles Area*

by ROBERT E. ATKINSON



Introduction

An Oriental garden is completely different in concept from gardens of the West. The purpose of the garden is to provide a place of contemplation where one can stroll or sip tea and enjoy intimately the beauties of nature. The Western garden, on the other hand, provides a setting for the home and is primarily for others to enjoy. Those Western gardens that are walled are screened for private play and relaxation, not for revery and communing with Nature.

This review of Japanese gardens in the Los Angeles Area is written, not only to stimulate the building of more Japanese gardens, but also to show how a corner or a small area can be developed into a shrine or altar where one may pray or silently worship. This function of a garden, lacking in western tradition, offers many advantages for consideration.

Indeed there is much we can learn by studying western adaptations of Japanese gardens, both in design and utilization of materials that we may want to apply in our gardens. To enjoy these concepts it is not necessary to become a disciple of Buddhism or to embrace the Zen philosophy. But a heightened appreciation for, and understanding of, these basic tenants will be increased by adding these principles to our total gardening experience.

Japanese gardens are especially well-adapted to small areas where space is at a premium, as so often occurs in the city. Frequently these locations are shaded by high walls and tall buildings. Soil is often sterile and rocky and, in the case of roof gardens, shallow and poorly drained. A lawn and flower border in such a place is not possible.

In these situations one would be wise to abandon all preconceived notions of gardening and utilize arrangements of rock, pebbles and a few choice plants that will grow in such a problem location. Thus you would be constructing a garden similar to those seen in Japan. By eliminating the traditional Western garden's colorful annuals and lawn grasses you would avoid many insoluble difficulties. By adding Japanese accessories you would create a garden in the Oriental tradition, but with a statue of St. Francis or the Virgin Mary, an entirely unique garden scheme would be accomplished.

Japanese gardens often convey a feeling of spaciousness all out of proportion to their size. This is achieved by the use of miniature varieties and plants kept in small scale by pruning. Using the "borrowed scene technique" which will be discussed later, is one of the basic tenants of Japanese landscapers.

The greatest advantage, however, is the fact that in any situation a Japanese garden can be kept neat and thrifty with very little effort. This low maintenance aspect of Japanese gardening has a great appeal in these days of high labor costs and little desire to spend leisure time mowing a lawn or planting flowers. It explains why these gardens are increasing in popularity, and is their greatest asset.

Guiberson Garden

One of the most beautiful Japanese gardens of the "shin" (elaborate) type to be seen anywhere outside the Orient was built by Mr. Gordon Guiberson on his hillside property in Bel-Air and dedicated to the memory of his mother, Ethel L. Guiberson, pioneer garden club worker in California.

Before any actual construction began, Mr. and Mrs. Guiberson visited Japanese-type gardens throughout the United States and in Japan studied the most famous public and private gardens, parks and landscaped shrines. In Japan he personally selected the rocks, antique stone water basins, lanterns, bridges, pagoda, and the



Traditional bridge of rectangularly cut stones and mill stones used for stepping stones.

rustic tea ceremony house which give the garden its remarkable authenticity. The preliminary planning and design, the search for appropriate plant materials, took many months, and after a year and a half, using three Japanese artisans, a crew of laborers, tractors, bulldozers and cranes, the garden was finished.



Tea house, partially screened by the forked pine tree, is in an isolated part of the garden.

The main entrance to the garden is similar to that of a famous estate in Kyoto, Japan, and was designed and constructed in Kyoto, then dismantled for shipping and reassembled in Los Angeles by its designer, Mr. Kazuo Nakamura. The bamboo fence connecting the main gate is called Katsura-type, copied from the famous Katsura in Kyoto. This garden is considered the highest achievement in Japanese landscape art and is maintained under the protection of the Imperial Household.

The stone path leading from the gate to the level of the pond is called "tatami-ishi", meaning stone mat pattern. It is built with natural uncut stone laid flat for ease of walking. The round stepping stones beside and across the pond are ancient mill stones and the two rectangular stones in the pond are the "devil casting stones", so named because a person pursued by a devil could suddenly step aside

at the end of a rectangular stone, causing the pursuer to fall into the water. Both the round and rectangular stones resemble those in the garden of the famous Heian Shrine in Kyoto.

The large, flat Japanese stone in the traditional position by the pond is called the "thinking" stone, where the lord or owner sits and contemplates his garden creation. The largest stone in the garden, weighing nine and a half tons, seen in the pond, is symbolic of a ship on the sea. Also from Kyoto, it is called "Kibune-ishi", or "Noble Ship" stone.

On the shore of the pond is a symbolic "beach", formed of flat, black pebbles similar to that in the Katsura garden, with tiny pebbles carefully filling the joints. The small, round lantern on the "beach" represents a lighthouse.

The log bridge at the pond is the type one might cross on one's way to enjoy an outdoor bath in one of the famous hot springs in Japan. It is built of small logs laid at right angles with two relatively huge logs across the banks, and paved with a fine-aggregate concrete.



The path is marked by vertical stakes of saplings with their bark intact, overgrown with baby-tears.



A dining area shaded by an old sycamore charmingly situated.

Across the pond and away from the center of the garden, screened by bamboo and black pine so that it is partially hidden from every angle, is the garden house. This technique of shielding and concealing an object is common Japanese garden design. Stones are often sunk deep in the earth so they're only partly visible, and stone lanterns are shielded by a veil of leaves. This principal was expressed by the great Haiku poet, Matsuo Basho, when he asked, "If everything is expressed, what remains?" And so the little garden house, inconspicuous in appearance but exquisitely furnished with valuable works of art, is used for the tea ceremony, for a secret rendezvous or for quiet contemplation. Mr. Guiberson had his garden house entirely built in Japan. Above and under the garden house, a Japanese white stone design, symbol of a dry stream bed, gives an illusion of running water.

Overlooking the garden is the "hokora" (family shrine), built by the same Kyoto artisans who made the entrance gate. The roof is made from Japanese cryptomeria. All woods were hand-hewn and the bronze ornamental knobs were smoked by burning cedar leaves. The hokora shelters a rare, gold-leafed, hand-carved statue of Buddha and two Chinese stone figures representing lions which were imported from Bangkok.



Fierce stone lions imported from Bangkok guard the entrance to the shrine.



This ornate basin is placed at the entrance to the shrine.

Stones have been used in Japanese garden design since the sixth century. Their arrangement is a difficult and intricate art but when well-done they appear as symbolic of nature. Many hundred tons of stone and rock were brought for placement in the Guiberson garden. Although all of the special garden-type stones were shipped from Japan, the lichen-covered, dark brown stone came from rock quarries at the foot of Mt. Baldy in Los Angeles County. The large stone shaped like a turtle is naturally formed and was collected from the Hozu River in Kyoto. In Japan, the turtle symbolizes luck and longevity. The most valuable and the oldest man-carved stone in the garden is the Buddha Stone, over a thousand years old. It represents Buddha seated in 15 positions.

Some classic stonework is to be found in the pagoda, over 500 years old. Following ancient custom, white sand or small pebbles were placed in the basin at the pagoda's base to symbolize Buddha's bones. Roof levels of a pagoda are always odd in number — this one is seven-tiered.

* * *

Stone lanterns are synonymous with Japanese gardens and serve to light paths or for presentation to shrines and temples. This garden contains all four types of Japanese stone lantern. One is known as the "snow-viewing" lantern. It is always

placed near water with white pebbles at its base to denote a snowy scene. Lanterns used for donations to temples to receive the blessings of Buddha, or to Shinto shrines to receive the blessings of elemental gods, may bear names of particular shrines. Among the varied-shaped lanterns developed for purely decorative purposes, one of particular interest is the crude Korean lantern introduced into Japan in the sixth century. Another interesting lantern is the Christian type, originating during the Christian persecutions of the seventeenth century when worship was held in the secret of the garden before lanterns with stems carved to signify the Cross or the Virgin Mary.



Paths are adequately lit by authentic stone lanterns.



Azaleas bloom on the hillside below the shrine under the native live oaks.

There are two types of man-made stone water basins — the tall basin for use in a standing position and the lower type for a kneeling position. Water is ladled out for drinking or for washing mouth and hands prior to the tea ceremony. The water basin on the right of the entrance path is naturally formed and was found at the bottom of a waterfall where the water eroded the rock for centuries, resulting in a natural cup shape.

The type called "Buddha Facing Four Directions" originated in Kamakura around 1300 A.D. and was also originally used as a pagoda base.

A tall, natural water basin, traditionally used near a building, can be seen near the garden house. By the path up the hill are all the other types of water basins found in Japan.

To the right of the round water basin is a rock upon which a tub of warm water was placed during severely cold winters; on the left, a rock has been provided to place a lantern in case of darkness; and the rock in front is for stepping or kneeling. Four round stones arranged as a pyramid prevent water from splashing on the feet. Such a basin may be both practical and ornamental. Another famous type of water basin near the Hokora is inscribed in Japanese, "dew-catcher".

* * *

The kakei, or movable bamboo pipe section located near the pond is called "wild boar scarer". As water fills it, this pipe lowers and strikes a rock, making a noise. According to legend, this noise frightened away wild boars. This pipe perpetually empties and refills to repeat its sound. It may also be used as a fountain.

Only plants that actually grow in Japan are used in Mr. Guiberson's garden, although many of these are of foreign origin. Redwood and California live oak, Monterey and pinion pine, are among the imported plants of the tree type. Japanese natives to be found there are black pine, flowering cherries, flowering magnolia and Japanese maple.

In winter and spring the garden is a blaze of color from azalea species carefully selected to span a prolonged blooming season. First to flower are the Belgian indicas, starting in November — then again in February and March. Next come the Kurumes, followed by the Southern indicas and, lastly, the late-blooming macranthas which give color until late in May.

Three species of camellias are to be found in the garden, as well as the closely related *Thea* (tea) and *Ternstroemia*. *Camellia sasanqua* blooms from October to December. *C. japonica* starts in November and continues through April, and *C. reticulata* often has flowers opening in May.

From the giant to the pygmy type used as a ground cover, the garden abounds in bamboo. You will find the rare black and striped stem type, along with the more common golden goddess and *Bambusa ventricosa*, known as Buddha's belly. In shady areas where bamboo would fail, the bamboo palm, *Raphis excelsa*, and heavenly bamboo, (Nandina), have been used for dramatic effect.

Gordon Guiberson has expressed a Japanese sensitivity in his creation of this tribute to his mother — a quiet sanctuary, a place to walk through and to look at — to enjoy in peace and solitude. This stillness, simplicity and coolness must be achieved to be truly an authentic Japanese garden.

Chorisia speciosa

ARBORETUM RE-INTRODUCTION

Common Name	: Floss Silk Tree
Scientific Name	: <i>Chorisia speciosa</i> St. Hil.
Family	: Bombacaceae
Origin	: Southern Brazil, Northern Paraguay and Northern Argentina.
Form	: Tall straight tree to 60' usually with spiny trunk.
Flowers	: Very large and showy. Variable light to dark pink with broad strap-like petals.
Foliage	: Palmate — attractive bronze color in young stages.
Growth Rate	: Rapid — up to 4 feet per year when young.
Soil Requirement	: Light sandy soil with high humus content, good drainage.
Exposure	: Full sun.
Temperature Tolerance	: Leaves will tip burn at about 25° F.
Water Needs	: Bi-monthly soaking during hot months. No water during month or so when foliage drops.
Pruning	: Removal of dead wood only.
Pests	: None of record.
Disease	: None of record.
Propagation	: Seed, which must be fresh — no special treatment needed, or T-bud grafting for selected colors.
Remarks	: One of the finest large flowering trees for Southern California. Spectacular when in full bloom.

The floss silk tree which blooms in fall and winter is well-adapted to Southern California. Several old trees are known in the area, including one at the Bel Air Hotel and one at the Automobile Club of Southern California, Adams and Figueroa streets. Each has achieved a height of 75 feet in the 60 or more years since they were planted. A 50-year old specimen survives in Pomona and there is one at the Patton State Hospital east of San Bernardino.

The tree flowers when about ten years old from seed. Peak bloom is in November. Flowers rarely set seed in this area. In 1953 the Arboretum received seeds of the tree from Dr. Samuel Ayres, Jr., who was visiting in Brazil. Some 400 plants obtained from this lot of seed have been distributed to nurseries and other interested groups.



Chorisia speciosa St. Hil.

An evergreen open tree to 60 ft. with green bark. Leaves compound, palmate, 4 to 8 in. wide, alternate, long-petioled. Leaflets usually 5 or 7, elliptic or sometimes ovate or obovate, dentate, glabrous, dark green above, lighter beneath.

Flowers pink, 3½" to 4½" across, short-pedicelled, solitary in the leaf-axils, crowding the terminal parts of branches, appearing in September through February.

Fruits capular, pear or avocado-shaped, bursting open to release their floss-encased seeds.

Native of Brazil.

Huntington Gardens

One of the many attractions of the Huntington Botanical Gardens of San Marino, California, is the Japanese garden. It is located to the west of the famed Art Gallery and Library in a ravine that has been converted into a glimpse of ancient Japan. A small lake, arched by a red bridge, is surrounded by an authentic garden done with skill and taste. The garden is 900 feet long and covers five acres. Winding paths and tiny bridges wend among the plants of Japan: camellias, azaleas, cherries, wisteria, dwarf maples, pines and cycads.



An ancient bas-relief, worn by time and scarred by vandals, is an unexpected encounter along the garden path.

The Huntington Gardens are a portion of a ranch Don Benito Wilson acquired when he married Margaret Hereford. When Wilson's daughter, Maria Jesus, married James deBarth Shorb in 1869 this parcel was conveyed to them and their home was built in 1877.

This ranch was purchased by Henry Huntington in 1902 and he immediately hired William Hertrich to plan and plant the grounds. Huntington built his Georgian-Colonial mansion on the site of the old Shorb house.

The cactus and palm gardens were planted; a lake with waterlilies and waterfowls constructed. As a last moment's inspiration, just before the house was to be occupied, the Japanese garden was conceived and executed. In a canyon dammed by Mr. Shorb, Hertrich demolished the dam and installed rocks and waterfall, excavated ponds which were lined with concrete. He built bridges, walks and steps, meanwhile searching everywhere for Japanese plants.

He found a commercial tea garden in Pasadena that was for sale and bought it, lock, stock and barrel. The trees were dismantled and carted, piece by piece, to their new home at the Huntington estate. Lanterns, pagodas and ancient statues were ordered from Japan. Later Japanese craftsmen constructed the Full Moon Bridge and the ornate temple to house the giant bell.



Full Moon Bridge — so-called because its reflection in the water completes the full circle.

Robert Goka Garden

It is not always possible to use water in a garden, and in the Robert Goka garden in West Los Angeles, streams, waterfalls and ponds are simulated. By using vertical rocks a waterfall is suggested, while the pond and stream are conveyed by means of fine, worn pebbles. The stream banks are marked by larger rocks.



Polished river pebbles symbolize a gurgling brook while the larger rocks indicate the bank.

One of the most famous gardens in Japan, the temple garden of Ryoan-ji in Kyoto, uses this technique. A rectangle of fine white sand is raked to indicate rippling waves and classic arrangements of rocks and stones create an effect of an ocean, with dark islands jutting from the water.

Goka has developed a cool, rippling stream with washed stones and choice rocks. The stream cuts through the garden from a higher point where water seems to gush from between two huge boulders.



From the placement of the two huge boulders you can almost see the water gushing in this dry garden.



Who can fail to see the rippling stream, although not a drop of water is used!



A more formal waterfall in this dry stream is symbolized by these giant vertical boulders.

Brubaker Garden

The George Brubakers of Brentwood, on a trip to Japan, became imbued with the beauty of the clean, modern lines and contrasting textures they found in the gardens in Japan, and decided that the subdued colors of Japanese landscaping would give them the restful seclusion they desired. Mindful of the importance of authentic artistry, they retained Eijiro Nunakawa and his associate, Shinichi Maesaki, to design their garden. Mr. Nunakawa was born in Tokyo and graduated from Tokyo Agricultural University. He has not only over 30 years of experience in landscaping, but his father and his grandfather spent their lives in garden design and construction.

It is difficult for the Western mind to fully appreciate authentic Japanese landscaping. Democracy so thoroughly instills tolerance of opinions and freedom of choice it makes us neglectful of absolutes which occur even in the art of landscaping. We fail to admit, for instance, that there is one best way to place stepping stones, one best choice of plant for any given location. Acquiring this perfection in landscaping requires not only years of study, but the instinctive ability acquired only when successive generations follow the same profession.



A roll of black bamboo stalks forms a railing of this *do-bashi* (mud bridge). The base is of chestnut.



Lantern placed on the ground to light the mud bridge. The concrete aggregate replaces the original mud.



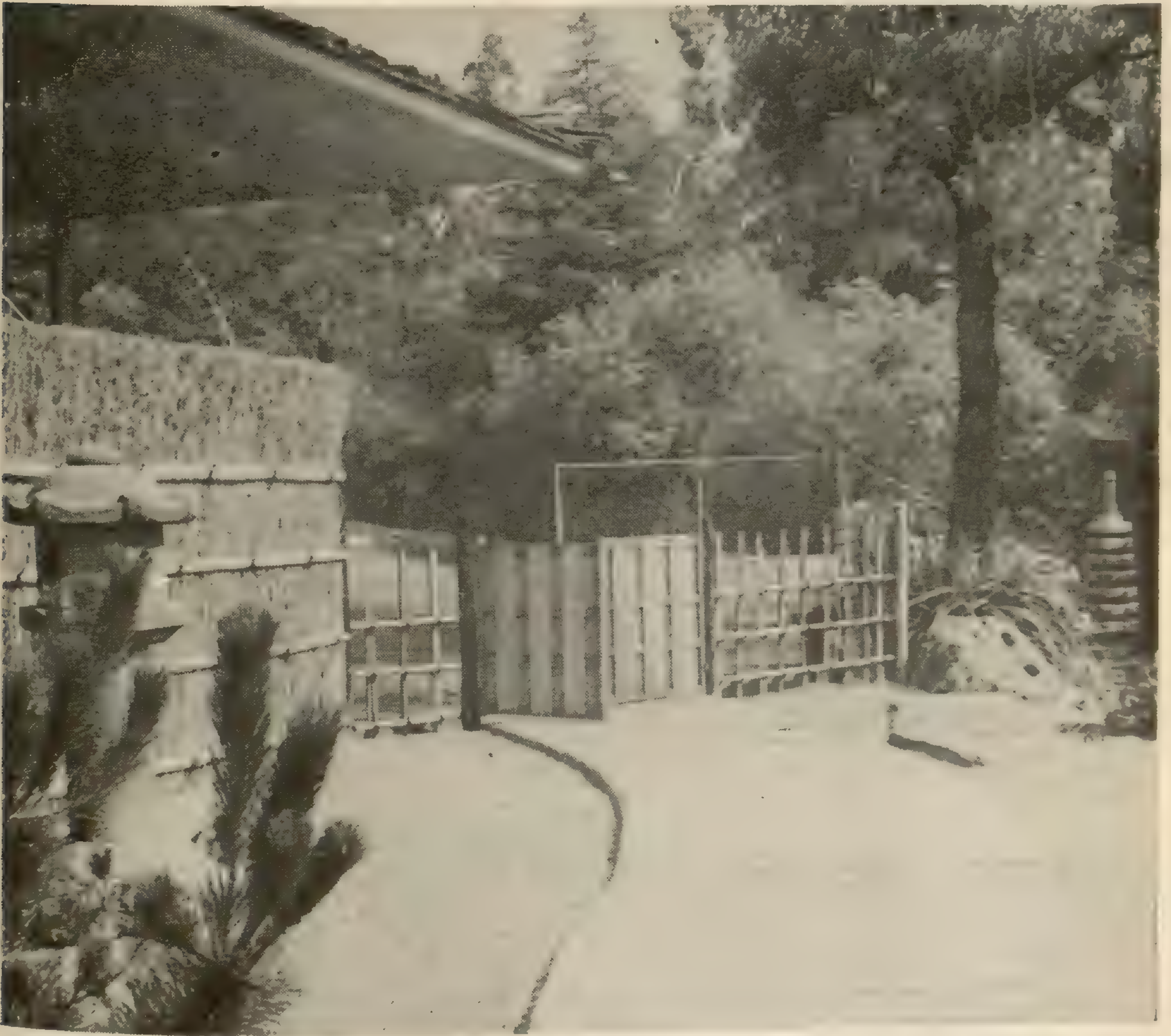
An elaborate bamboo screen allows privacy in front area.



From a wide sloping lawn a view of an Eucalyptus grove. This is an example of the "borrowed scenery technique".

Japanese gardening is an ancient art full of "auspicious" ideas. We can learn from the Japanese the use of gardens for meditation, for strolling, rather than for playing. Their ideal is to create a beloved landscape of sea or mountain, a sylvan solitude of seaside tranquility. Rock groupings express aesthetic principles by means of harmony of line and balance of masses. But it is not entirely design that dictates the choice of plants, rocks, water, or sculpture. Traditional and legendary principles with deep almost religious significance guide the hand of the creator of a Japanese landscape.

The emergent California style of architecture embodies the Japanese concept of home as involving indoor and outdoor living. In the adaptation of these features to the personality of Westerners and their environment in Southern California, the Japanese influence has been considerable.



A Japanese black pine and especially selected stone lantern grace the rear entrance. The fence allows you to look through but gives privacy.

Clean, modern lines, contrasting textures, subdued colors, restful seclusion — these are the attributes that make a Japanese garden so popular. The Japanese garden deserves even greater emphasis, however, for an important but seldom recognized factor: low maintenance. Here in Los Angeles the high cost of gardening help has put a premium on low maintenance. The naturalistic Japanese garden contrasts strongly with the unnaturally neat and symmetrical geometric patterns of the English and American gardens. The lawns and hedges that require constant care are not found in Japanese gardens.

A mulch of fine pebbles is used in lieu of grass or ground cover in all areas except where a greensward is needed, and there low maintenance dichondra is used. Rocks for decoration and fences that need no painting, bridges, lanterns and exposed aggregate walks are all utilized with low upkeep in mind.



Rounded beach pebbles are softened by the soft gray ground cover, *Lotus bethelotti* (pidgeon beak)

Although flowering plants of azalea and chrysanthemum are highly prized, the colorful annual and perennial beds typical of Western gardens are not used at all in Japan. The fundamental difference in principal is illustrated by the comparison of a bouquet with a flower arrangement.

The Japanese tell the story of the father who asked his son to tidy up the garden when they were expecting guests. The boy raked and swept the garden, but the father was not satisfied. A second and third time the father sent him back to perfect the job. Finally the boy assured his father that "not a dead twig or a stray straw was to be found anywhere in the garden." But the father

rebuked him and stepped over to the maple tree and shook it. It was early autumn and the gold and crimson leaves scattered over the moss-covered ground. "There," the father said, "that is the way to tidy up the garden."

But best of all in these days of high taxes is the "borrowed scenery" technique of Japanese landscaping. This secret method, called *Shak-kei-en*, allows the owner to use land owned by others to his own advantage without cost, taxes or upkeep. A pleasant scene is never ignored, even though it is outside the owner's premises. A view of adjoining woods, the neighbor's tall eucalyptus tree, a distant coastline, a towering mountain, or maybe the twinkling city lights are incorporated into the garden and become an integral part of it.

One of my favorite stories is of the great Japanese landscape artist, Rikyu, who lived more than 365 years ago at Sakai on the slope of a hill that commanded a breathtaking view of the sea. The story goes on to tell of the day he completed his garden and invited his friends to his "open house". His guests were disappointed and somewhat dismayed on entering the garden to find a row of evergreen trees had been planted, obstructing the view of the ocean. When the time arrived for the tea ceremony, the guests, one by one, approached the stone water basin to rinse their hands. Then they understood and appreciated the deep thinking of their host, Rikyu. As each bent over the water basin, they saw through the tree trunks the distant sea, and were forced to compare the water in the basin with the vastness of the ocean. In this humble posture they realized their place in the universe and their relationship to God.



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THE INDIAN PEA FOWL (*Pavo cristatus*)

A Botanist in India

*Lasca
Leaves*

AUTUMN 1965
Vol. XV, No. 4

MISSOURI BOTANICAL

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Quarterly publication of the California Arboretum Foundation, Inc.

VOL. XV

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NOTE: The last issue of LASCA LEAVES (Summer, 1965) was devoted to Japanese Gardens and featured the Guiberson Garden. This garden is now the property of the University of California, Los Angeles, and is under the direction of the Botanical Garden. It is hoped that it will prove useful for botanical, horticultural and design students. Groups or individuals may make arrangements to visit the UCLA Japanese Gardens by writing for a reservation to Dr. Mildred E. Mathias, Director, Botanical Garden, University of California, Los Angeles, California 90024.

ON THE COVER — See description page 92



TAJ MAHAL

A Botanist in India

INTRODUCTION:

Why India?

The combination of the Aryan and Dravidian peoples found in India is said to be complicated by every degree of intermixture and represent every stage of culture from savage Gonds to highly cultivated Hindus. Likewise, India is horticulturally compounded of all that has been brought from all over the world and blended with what has flowed from neighboring lands throughout the cycles of time. So what botanist could resist the opportunity of a visit potentially so challenging?

The infinitesimal cycle of six months which moved our family through the scenes of India referred to in this issue was made possible by a Fulbright Lectureship Award which carried three responsibilities.

1. To lecture in Plant Physiology to the advanced students at Balwant Rajput College;
2. To advise in the development of a botanical garden for the use of the colleges of the Agra area; and
3. To assist in expanding the citrus production of the Agra area.

Of course we had our own additional interests, particularly the project of collecting seeds and herbarium specimens for use at the Arboretum. Thus, one of the features of life in a Hindu college which most perplexes western professors — the frequent interruption of teaching programs to observe extended religious holidays — was a boon to us.

Our vacation travels took us from the Himalayan foothills clear down to Ceylon as well as back and forth across India and brought many fascinating experiences. But perhaps most rewarding of all was the very different way of living at Bichpuri, eight miles west of Agra, among delightful and resilient people, and working with leaders who can be truly inspiring on practically no budget!

We like to recall sitting on the vine-draped verandah of Professor Emeritus N. M. Mukerjee in Agra, listening to his cultured voice relating his recollections of a long and illustrious career. Another scene was the animated Christmas party, crowded into the attractive home of an American Embassy official in Delhi, where bright saris and turbans far out-shone our sober western dress: here we met Pramila Pandit Barooah who told us the story now printed here.

And coming upon a freshly white-washed shrine of Saraswati, goddess of knowledge, draped with garlands of marigold, focused our attention on the peacock always depicted in her company, and it reminded us of home as written here by our long-time friend and sponsor, Caroline S. G. Munro.

It was arranged for Mrs. Stewart to informally teach physical education to the women students in the Bichpuri hostel, even to presenting with them "Las Posadas" as we do each Christmas at the Hugo Reid Adobe here at the Arboretum. Our

teen-age daughter, Carol, attended French class, played badminton and generally took part in student life at the college. All three of us were cordially feted on many academic and social occasions and carry with us a warm appreciation of all we learned.

This issue is dedicated to the many kind people in India who made possible the success of our stay. The number of helpful individuals is too large to enumerate; however, we must mention Dr. Olive I. Reddick, Director of the United States Educational Foundation in India and her staff; Dr. R. K. Singh, Director of Balwant-Vidyapeeth, Bichpuri; Dr. S. P. Singh and staff of the Botany Department of Balwant-Rajput College, Bichpuri; and Dr. and Mrs. Al Ayers of the Agricultural Research Service, U. S. Embassy.

To these, and many others, the Stewarts say, "Namasthe."
... and *that* is why India!

The Stewarts —

Bill, Maria and Carol

Vegetation areas of India and Pakistan generalized.



- | | | | |
|-----------------------|-----------------------|------------------------|------------------|
| 1. Western Himalayas. | 2. Eastern Himalayas. | 3. Ganges river plain. | 4. Indus |
| | river plain. | 5. Deccan plateau. | 6. Malabar coast |

Development of Botany in India

PROF. P. MAHESHWARI

(Excerpts from "Botany in Indian Universities." Report of the University Grants Commission Review Committee. Chairman, Prof. P. Maheshwari, Head of Department of Botany, Delhi University, Delhi. University Grants Commission, New Delhi, 1963. Price Rs. 3.50; U. S. Cy. \$1.26. 82 pages.)

While the ancient Hindus had a considerable knowledge of plants, botanical research in the modern sense began in this country only about a hundred years ago. Its foundations were nevertheless laid in the 16th and 17th centuries by the European intruders. Worthy of special mention is the name of Heinrich van R  ede tot Draakenstein, the Dutch Governor of Malabar and an amateur botanist, who made a large collection of plants in 1676 through a local Brahmin. These were sketched by a Malabar artist and later described in Latin as "Hortus Malabaricus" in 12 richly illustrated volumes having 794 plates. Some other works on the plants of Ceylon and Burma were also published by the Dutch in the 17th and early 18th centuries.

The credit for introducing Linneaus' binomial system of nomenclature in India goes to his Danish pupil, John Gerard Koenig, who came to India in 1768, and formed a small botanical society. Its members not only collected but also exchanged specimens, prepared herbarium sheets and sent these to Europe for fuller identification and description. Similarly, the French in Pondicherry also made large collections of Indian plants and sent them to Paris where these were studied and described by Lamarck, Poiret and others. In the 18th century the Dutch and French had been ousted by the British who secured a firm hold and occupied large territories. From the botanist's point of view the most outstanding event of the period was the establishment in 1787 of the Royal Botanic Gardens at Calcutta which soon became one of the best and most important centres of botanical research in the tropics (discussed later in detail). The 19th century was the 'golden period' in the progress of systematic botany. British botanists, especially Roxburgh, Wallich and Wight, contributed a large share to the advancement of this subject. Plants began to be collected and described from all over the country leading to the founding of the well known Sibpur Herbarium at Calcutta.

Other important venues of botanical work started at Saharanpur and Dehra Dun. Most important, however, was J. D. Hooker's visit to India in 1848 which gave a tremendous push to taxonomic studies. The close of the 19th century and the beginning of the 20th century saw the publication of not only Hooker's "Flora of British India" but also several regional or local floras. Notable among these were: "Punjab Plants" by Stewart; "Flora of the Upper Gangetic Plain" by Duthie; "The Forest Flora of North West and Central India" and "Indian Trees" by Brandis; "Ferns of the Southern India" and "Ferns of British India" by Beddome; "The Trees, Shrubs and Woody Climbers of the Bombay Presidency" by Talbot; and "The Botany of Bihar and Orissa" by Haines. Indian mosses engaged the attention of Mitten and later of Bruhl. These were followed by Gamble's "Flora of the Presidency of Madras"; Fyson's "Flora of the Nilgiri and Pulney Hill-tops"; Kirtikar and Busu's "Indian Medicinal Plants"; Bor's "Common Grasses of the United Provinces" and Kanjilal's "Flora of Assam".

It is quite natural that during these early days botany comprised mainly the collection and identification of plants. However, other branches of botany emerged in the beginning of the 20th century. Morphology constituted the first phase of development. The invention of the microscope had already opened up new fields of studies in the West but India was almost a hundred years behind them. The earlier years of the 20th century were particularly rich in papers dealing with ecology, morphology, anatomy and embryology. Plant pathology, physiology and genetics came in later. E. J. Butler will always be remembered for his work on fungi and the Howards (husband and wife) for their work on plant breeding. Bruhl and Kashyap gave a great impetus to the progress of cryptogamic botany, and Dudgeon and Sampathkumaran to the phanerogams. The credit for developing palaeobotany goes almost entirely to Sahní who became known internationally for his extensive and intensive studies on Indian fossil plants. In algae the Madras school under M.O.P. Iyengar acquired a high reputation both in India and abroad.

Today almost all phases of botany are being developed. Pure morphology is gradually giving place to experimental morphology and physiology. Cytogenetical studies are popular in agricultural institutions, but the largest number of persons seem to be engaged in mycology, plant pathology and microbiology.



Lloyd Botanic Garden, Darjeeling.

BOTANICAL GARDENS AND HERBARIA

In ancient times India was a land of numerous gardens and beauty spots thriving under maharajas, sultans and lovers of grace and grandeur. But these places were meant mainly for recreation and enjoyment. Except in the early Buddhistic period, when pharmaceutical gardens seem to have been established for growing drugs and herbs to supply to the physician, there is no evidence of the existence of herbaria or gardens of scientific or botanical interest.

The British established a few gardens in the 18th and 19th centuries with the intention of facilitating the exploitation of the plant resources of this country for their own trade and benefit. Much of our botanical progress has depended upon the activities of these gardens. The more important ones are mentioned below:

Indian Botanic Garden, Calcutta — An army officer, Col. Robert Kyd, suggested to the East India Company that a garden should be started in Calcutta with a view to growing teak for ship building and various spices and other articles of commerce for sale in Europe. The benefits of the scheme greatly appealed to the Directors of the Company. Kyd's proposal was accepted on July 31, 1787 and he was also made the first honorary Superintendent of the garden. He was succeeded by William Roxburgh, a man of great distinction. In 1864 and again in 1867 the garden was nearly ruined by two devastating cyclones which gripped Calcutta. Thanks to the hard work of G. King, who became Superintendent in 1871, it was reorganized once again. King also initiated the publication in 1887 of the "Annals of the Royal Botanic Garden". David Prain, A. T. Gage, and successive superintendents improved the garden still further. It now occupies an area of more than 270 acres. About 15,000 plants, representing approximately 2,500 species, are arranged in different geographical divisions. There are lakes and ponds containing aquatic plants, several ferneries, orchid, palm and succulent houses, nurseries, and arboreta. The garden has been of much value to the students and teachers of botany all over the country and its utility would be greatly enhanced if it were administered by the center instead of by a provincial government. (Since this was written, the Indian Botanic Garden has come under the direct control of the Botanical Survey of India.) It is a national asset and should not be allowed to suffer for lack of funds.

Lalbagh Botanic Garden, Bangalore — Started about 1760 by Hyder Ali as an orchard, it was named Lalbagh because of the red roses that were grown there in profusion. In 1865 it became the state botanical garden. It has an area of about 250 acres and is famous for its beautiful collections of palms, araucarias, bamboos and orchids. Many plants yielding oils, scents, fibres, resins, gums, dyes, tans, timber, rubber and fodder are also cultivated. Useful work has been done in the introduction, testing, establishment and expansion of a number of varieties of fruits and vegetables.

Government Horticultural Garden, Saharanpur — This garden began its existence in the time of the Marquis of Hastings and played an important role in naturalizing many plants from America. Some of them are: potato, tobacco, pineapple, guava, chillies, papaya, sapota, logwood, mahogany, and several other plants. By 1820 it had become an important center of research in taxonomy and was also maintaining a good herbarium. It was from Saharanpur that Falconer, Jameson and Duthie made their well known contributions. The present trend has

been to develop it for horticultural research for which it now has a good laboratory and qualified staff.

Lloyd Botanic Garden, Darjeeling — In 1878 an old and well known resident of Darjeeling, William Lloyd donated a piece of beautiful land with an area of 40 acres, which was developed as a branch establishment of the Royal Botanic Garden, Calcutta. During the curatorship of A. T. Jeffrey, cinchona planting operations were successfully carried out in this garden. In 1902 almost all the non-herbaceous plants were catalogued and a topographical map of the garden prepared to show the position of the plants. From 1910 onwards, the collection and distribution of seeds, bulbs and plants has become an important activity of the garden. It has excellent rockeries, nurseries, hot-houses, medicinal and student gardens. There is a good collection of exotic species from China and Japan, and representative plants from North Western India, Burma and the Nilgiris. There is a small herbarium attached to the garden. With better financial support and energetic supervision the utility of this garden could be further enhanced.

National Botanic Garden, Lucknow — The idea of establishing a Botanic Garden at Lucknow originated in 1929, but it was only in 1946 that a formal proposal was made to the U. P. Government for converting the Sikander Bagh into a Botanic Garden. In 1953 it was taken over by the CSIR which has since financed it liberally. The garden is situated on the south bank of the Gomti river and has an area of about 70 acres. Large portions have been set apart for experimental work on the cultivation of ornamental, medicinal and other economic plants. There is also a good laboratory well equipped for research on various phases of pure and applied botany and an excellent hall has been set apart for the herbarium which will no doubt develop quickly.

Forest Research Institute Garden, Dehra Dun — The Forest Research Institute, Dehra Dun, not only has a large garden attached to it, but also possesses a large number of exotic and indigenous trees and shrubs. The Institute undertakes the collection and distribution of seeds of forest species for experimental work. It also serves as a good source of material for research purposes.

— For a large country like India the number of botanical gardens is very small and only some universities have one or two acres of land for their experimental plots without any botanical garden worth the name. This lacuna should be filled at least in the Third Plan period with generous grants from the University Grants Commission.

Gardening in India

PROF. N. M. MUKERJEE

(Excerpts from a talk delivered before the Rotary Club of Agra on July 24, 1963. Professor Emeritus N. M. Mukerjee is on the faculty of Balwant-Rajput College, Agra.)

Gardening in India from the earliest times to the present can be divided into three distinct times: Ancient, Mughal and British. Each has its peculiar features, characteristic design and kinds of plants.

Of the first period we have no surviving examples left in the country but we do have their descriptions in Pali and Sanskrit literature, carvings on stone at Bharat and Sanchi and the paintings in Ajanta Caves. From a description by Kalidas of his home garden in Meghdut we gather that just in front of the archway gate was the lotus pool in green marble and the ground in front of the house was planted with Mandar (*Bauhinia variegata*), Ashoka (*Saraca indica*) and Maulshree (*Spatholobus roxburghii*). There was a rock garden surrounded by golden banana plants and an arbor of Madhavi Lata Creeper surrounded by a hedge of oleander. The garden was a miniature forest, planted with indigenous trees and shrubs and was completely informal. The tradition of this type of garden was preserved in the Rajputana and Kangra paintings from ancient times up to the beginning of this century.

The second period begins with the establishment of the Mughal Empire in the early 16th century by Babar, who planted the first garden in Agra on the banks of Jumna — 'Hast Behisht', the Paradise place. Although we have description of some Indian flowers by Amir Khusru and information about intensive grape cultivation in the time of Ferozshah Tughlak, we have no other information about that period. It appears, however, that opium poppy, Mehndi (*Lawsonia inermis*) and damask rose were introduced by early Moslem rulers in North India and some plants of Arabia and Africa were introduced by the Arabs in Sindh, Gujerat and Malabar in earlier times. A number of Mughal gardens surviving in the country are Shahdara, Itmad-ud-daulla, Taj, Shalimar in Lahore and Kashmir, Pinjore and Aurangabad. The idea or motif behind the creation of a Persian style garden was that of a Heaven.

The square garden was divided into eight plots by paths paved in stone. Four gates on four sides faced East, West, North and South, and the pavilion or the mausoleum was placed in the center. It contained broad paths, a water channel, and two rows of cypress trees growing from east to west and from north to south. The plots on the sides of the walks had flower beds of roses and narcissi and other flowers making a patent carpet design. The rest of the grounds were planted with fruit trees — pomegranate, apple, pear, peach, cherry, almond and grape vines. In the Taj, however, the mausoleum has been shifted to the north near the Jumna River with a better effect.

The planting of fruit trees in a Persian style garden could be tolerated, as they are small trees bearing beautiful flowers. But the planting of Indian fruit trees such as mango, jaman (*Syzygium cuminii*) in Mughal gardens had a disastrous effect on the garden design for the whole place became choked with a jungle of fruit trees. This was the case of the inner court of Taj grounds, too, up to the beginning of the 20th century, when Lord Curzon intervened and gave it a complete renovation by clearing the front grounds and by laying out lawns, shrubbery and annual flower beds of definite colors.



Fountain pool at entrance to Clark's Sheraz Hotel, Agra, showing landscape use of water carried on from the times of the Ancient Mughals.

At the end of the 15th century, after the discovery of America, the Portuguese arrived in India by the sea route and established themselves in Goa. Portugal was a big colonial power in those days in both hemispheres, and the Portuguese are responsible for importing a number of useful plants from America to India in the 16th and 17th centuries, including kaju (Cashew nut tree, *Anacardium occidentale*), guava, papita (*Carica papaya*), pineapple, mirich (capsicum), tomato, potato, raspberry, tobacco, tapioca, maize, and flowering plants such as gajda (marigold), sunflower and zinnia. The French, Dutch and the British also arrived by sea route to India and founded small settlements in the country along the sea coast. They introduced European vegetables such as cabbage, cauliflower and peas, and some European flowers for cultivation in winter months in the plains of India.

The British period began in the 16th century when the British were in possession of this country, and their influence brought a distinctly different style in gardening. The special features of the gardens of this period were the creation of public gardens (Company Gardens), the division of the garden into three distinct sections (ornamental, fruit and vegetable), and the introduction of lawns, shrubbery and trimmed hedges. The greatest contribution by the English people was the introduction of annuals or seasonal flowers from all the temperate countries of the world for growing in the winter months to provide a blaze of glorious colors never before seen in the Indian garden.

In the early phase, English gardening was very formal or artificial, with ornamental fountains and garden decorations, flower beds of complicated geometrical pattern, trimmed hedges and topiary, and serpentine paths. After a time, a reaction to this monotony set in, and by the end of the 19th century, the formal "landscape garden" had gradually given way to the simple, "natural view" garden.

* * *

Some Highlights of our Hunt for a Yellow-Flowering Camellia

W. S. STEWART

During the past two decades, camellia growers have attempted to either introduce or develop a yellow-flowering camellia. The late Ralph Peer, past president of the American Camellia Society, spent many years searching for the yellow camellia (1,3). An Australian publication reported that in 1940 a yellow camellia was introduced from Asia to a nursery in England. Here in Southern California, through the sponsorship of the "Camellia Research Committee" and others, efforts have been made to locate an existing specimen of a yellow-flowered camellia and studies are being made in hopes that hybridization will lead to a yellow flower color. However, thus far there has been little hope for a yellow camellia from this work. J. G. Sealy in 1958(2) reported that there are three wild species of camellia (*Camellia flava*, *C. fleuryi*, *C. tonkinensis*) with yellow petals, native to North Viet Nam.

One of the reasons I was particularly pleased to receive the Fulbright lectureship to India in the fall of 1964 was that it might make it possible to continue the search for a yellow camellia. It is very unlikely that the yellow-flowered native species are confined to North Viet Nam and it had been my thought that they also could be found in some of the botanical gardens and tea plantations in the area in northeast India, approximately north of Burma or further west — possibly even in Assam, India.

You can understand our complete surprise and pleasure when, in October, 1964, while visiting the Royal Botanic Garden in Katmandu, Nepal, the Curator told us she had a beautiful yellow-flowered *Camellia japonica* growing in the conservatory. The plant she showed us was about 18 inches tall but, unfortunately,

not in bloom. She told us it was the color of brass and had been obtained from the Janak Nursery in Darjeeling. Fortunately, our itinerary during this particular Hindu holiday included a 72-hour visit to Darjeeling.

Mrs. Stewart, our 13-year-old daughter Carol, and I arrived in Darjeeling at midnight after a hard day's drive from Patna, the air terminal from Katmandu. The following day we set out to locate the Janak Nursery. The combination of rather vague directions, absence of adequate signs, our inability to read or speak Bengali, made our quest a long and complicated one. It was 5 o'clock in the afternoon before we came to the end of the road and the beginning of the trail which would lead us half a mile down the mountainside to the nursery. At an elevation of 6500 feet we were shrouded by clouds and fog and it was beginning to get dark. So it was with some hesitancy that I started down the trail, leaving Mrs. Stewart and Carol in the car. With barely daylight enough left to see there were camellia plants growing there, I arrived at the nursery, only to find that the caretaker spoke no English. I did manage to learn, however, that the proprietor of the nursery, Mr. Pradhan, lived in Darjeeling.



In India you are supposed to drive to the left — actually you drive on whatever is left to you by the bullock carts, goat herds, camel trains, tonga carts, rickshaws, hundreds of bicycles and thousands of assorted pedestrians. Our car is identified by the bed roll carried on top — a 'must' when travelling by auto in India.

In the dark I retraced my steps up the mountainside, found the girls safe and sound in the car, and we wound our way back through the beautiful *Cryptomeria* forests to Darjeeling.

The next day took us on the adventure of locating Mr. Pradhan. This required a bit of doing, but fortunately we found him home and willing to accompany us immediately to his nursery.

We all hiked down the mountain trail I had struggled over the night before, and at the nursery enjoyed a cup of tea while the nurserymen crated ten of the yellow camellias. Mr. Pradhan was very willing to sell these plants to me but warned there would be considerable trouble in exporting them from India. He told me he had obtained the seed in 1957 or 1958 from a Japanese gentleman who had named them "Full Moon," and the Janak Nursery carry them in their catalog under that name. When I asked Mr. Pradhan how yellow the flower color was, he picked a nearby beautiful yellow dahlia. He pointed to the heart of the dahlia and the outer petals and said, "No, it is neither the color of these nor these, but ah, it is the color of these petals here, the middle whorl of the petals of the dahlia flower."

It was truly with a sigh of relief that I saw the porter carrying the plants, well boxed and crated, up the side of the mountain, and to our car.

We left Darjeeling the next day after a rather quick tour of the famous Lloyd's Botanic Garden, and stayed that night in a Hindu hotel in the small town of Siliguri, about 425 from Calcutta. Departing at 4:00 a.m., we drove straight through to Calcutta, arriving at midnight, where we found a hotel, and carried our precious plants into the room and soaked them in the bathtub. It took an exasperating three days effort to obtain permission from the Indian Agricultural Authorities of the State of Bengal to ship our plants to Los Angeles. Five of the ten plants purchased were shipped via Pan American Airways in a bareroot condition, the only way it is possible to bring plants into the United States from India. The other five plants were held in India for a subsequent shipment.

There were many problems involved in establishing the plants at the Arboretum, but suffice it to say that as a result of this initial shipment, plus successive shipments, we now have one intact planting growing at the Arboretum, as well as a number of grafted plants. In addition, we have two intact plants growing under the USDA Quarantine Division in Glenn Dale, Maryland. (Ultimately, we were able to arrange to ship bareroot plants directly to the U. S. Plant Introduction Station and to have them held in quarantine with no fumigation.)

We are now confident we do have the "alleged" yellow flowering camellia established in the United States. It will be one or two years until these plants flower and we can answer the question, "Will it be a yellow flower under our growing conditions?"

If *Camellia japonica* "Full Moon" does as well for us here in Southern California as it does in Nepal and Darjeeling, it will truly be a wonderful addition to our horticulture and you will hear a joyous shout from the Arboretum!

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Mughal Gardens

Three Hundred Years Later

W. S. STEWART

Three hundred years is a scant pin-prick on the flow of time. According to the Hindu view, the four ages of the world began with a cycle of nearly two million years called the Golden Age; the next was one-fourth shorter and one-fourth less righteous; the third age was still a fourth darker and briefer; and the last, the present age of Kali Yuga, is the darkest and briefest of all — enduring a mere 432,000 years.

During a span of 200 years in the 16th and 17th centuries of our diminutive calendar, the Mughal Emperors who reigned supreme in what is now West Pakistan and Northern India constructed approximately thirty principal gardens. As the Mughals were conquering warriors from Afghanistan, Persia and Samarkand, they brought with them the garden traditions of central Asia and Persia, along with their experience in garden irrigation and canal construction.



Parterre garden, Amber Palace, Jaipur.

Square or rectangular in shape and divided into parterres, their gardens ranged in size from one third of a mile to a mile long and a quarter to a half a mile wide. In nearly every language the word 'paradise' connotes 'enclosed' and in keeping with this, all of the Mughal gardens are enclosed to create within the garden bounds a bit of paradise and to exclude the harsh dryness of the surrounding environment. The garden wall was usually serrated with battlements for fortification from warring princes and tribes, with small octagonal buildings (chedars) at each angle. In larger gardens there were always four main gateways, one centered along each side.

Carved watershoots where the water cascaded from one level to another provided a liveliness of motion, as well as a pleasant sound and a cooling effect through the evaporation of the foam and spray. Trees were planted to emphasize the general lines of the garden. Occasionally large trees at the corner shaded the squares of turf, or one immense, beautiful chinár tree (*Platanus orientalis*) would be centered in the quadrangle, or a mango tree would be surrounded by a raised platform of masonry or grass. This practice with mango trees and chinárs was observed also in gardens and lanes in Nepal. The raised platforms provided a pleasant, cool, attractive place for rest, relaxation and contemplation. In the very large gardens the flower bed portions bordered the canals and squares. Avenues of large trees under which tents could be pitched adjoined the flower beds to serve

as a place for members of the court to reside while carrying on negotiations and legislation.

In India, when one ruler passed away, the new emperor constructed his own new palace and gardens. One of the buildings in his garden was developed as his future tomb and there are several well-preserved examples of this type of Mughal tomb garden in India today. The central pavilion (baradari) was used as a summer palace and formed the mausoleum at death. In some cases, as with the Taj Mahal, the garden would be constructed exclusively as part of the tomb. It also was customary to maintain pleasure grounds and gardens outside of the cities, and usually one of these gardens was selected as the "owner's" last resting place.

Trees used in the gardens varied from orange, pomegranate, chinar, and mango to arghwan (*Bauhinia variegata*) and cypress. Grapes, figs, roses, daffodils, tulips, lilies, irises, hollyhocks, tuberose, flowering plums, poppies, violets and cyclamen were some of the plants used.

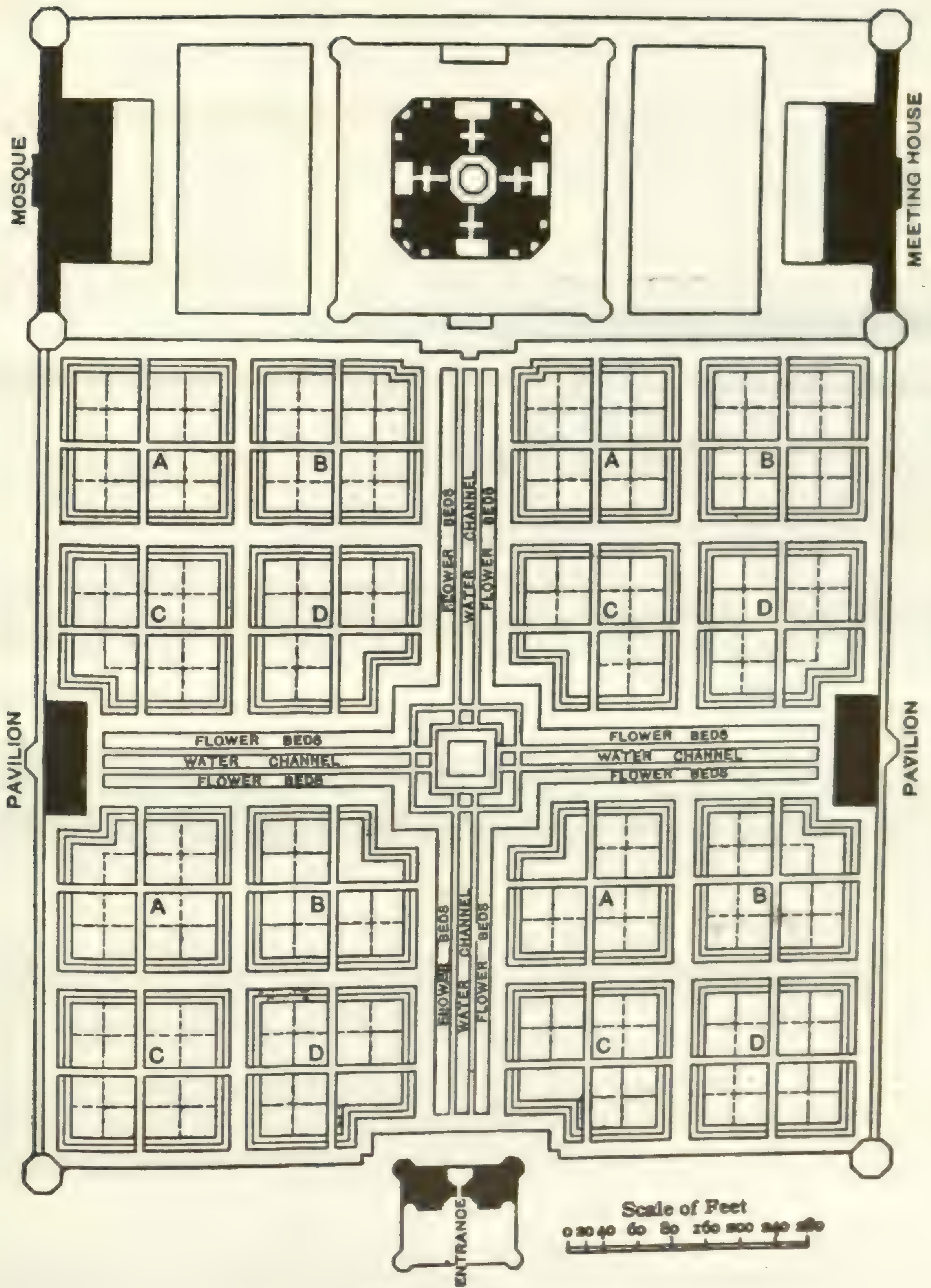
An excellent book, "Gardens of the Great Mughals", (1) is illustrated with original watercolors of the gardens as they may have appeared during Mughal times.

The outlines and features of about ten of the gardens are still surviving and it was our privilege to visit some of them and try to visualize their appearance 300 years ago. At that time they were a functioning entity and an extension of the living space of the palace; now they are in various stages of maintenance or lack of it, and serve as an interesting tie with the past in the horticultural history of India.

The Mughal gardens we visited fell into three categories: those of the plains or Punjab area; the foothill gardens; and those of the Kashmir.

The best-known garden of the Punjab is that of the Taj Mahal. It was constructed by the Mughal Emperor Shah Jahan to provide an appropriate tomb for his beloved queen Mumtaz Mahal, who died at the age of 25. The baradari normally found in the center of the garden was replaced by a marble lotus pool and the structure replacing the baradari was located at the eastern terminus of the main canal on the banks of the Jumna River. It is said that the Emperor planned to build a mirror image structure of the Taj Mahal on the opposite bank of the river, the two to be linked with a black marble bridge. His plans were never completed as he was deposed by his third son. When he died after seven years of imprisonment his body was placed in a casket alongside that of his beloved queen in the center mausoleum of the Taj Mahal.

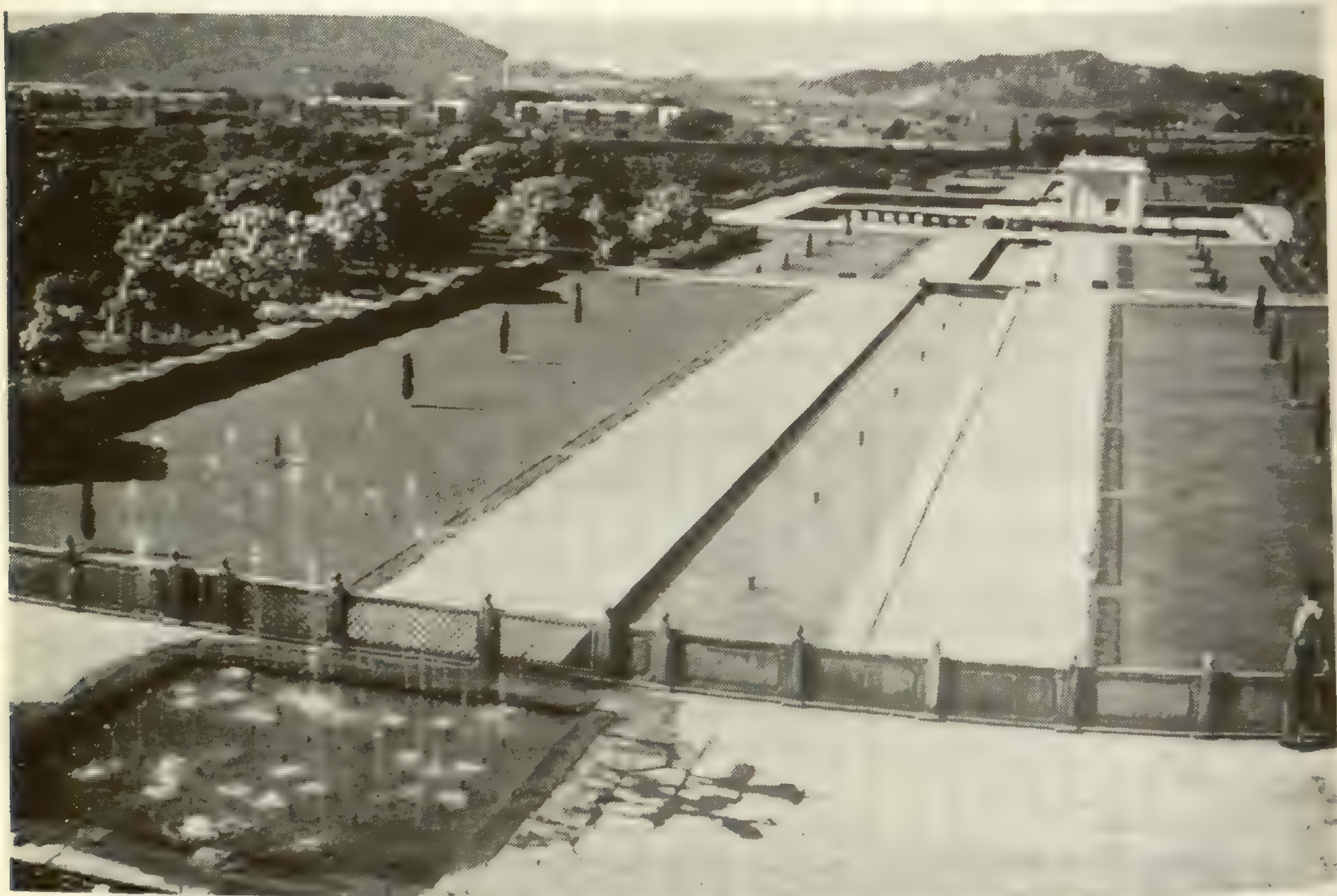
Built in 1725 in the beautiful rolling Himalayan countryside at Pinjore, far removed from any large city, is the last of the Mughal gardens to be constructed. Now on the main automobile road to the British summer capitol and "hill station" of Simla, the Pinjore garden differs from the plain gardens in that it is built in a series of three terraces. It is provided with an abundance of clear running water from an adjacent spring, and to see the full sheet of water flowing under the flooring of the various baradari and then cascading down the water curtain gives one a dramatic impression of the beauty (and approach to Paradise!) that these gardens had for people of bygone days. The grounds and architectural features are well-maintained and one can easily imagine that the members of the Court of Fada'i Kahn are there; that the ladies in Purdah are enjoying the second terrace garden with its protected area; and that the garden is well-fortified against attacks from adjacent princely states by its battlements and moat. With fruits ripening when the regal visitors are in residence, the scene is complete.



TAJ GARDEN.

(Colonel Hodgson's Plan.)

Having seen Pinjore, I would agree completely with the following description of it from "Gardens of the Great Mughals": "The Mughal gardens of the plains are sad for want of flowers; the terraced gardens of the Dal (that is Lake Dal in the Vale of Kashmir) have lost in part their original character; the gardens of the Kashmir Springs are but shadows of their former loveliness; but Pinjore, the late garden made by Fadaï Kahn at the holy spring of Panchpura, still serves its purpose practically unchanged since Fadaï first built this Indian country house and its garden."



Mughal Garden at Pinjore in the foothills of the Himalayas.

In spite of the excellent state of preservation of the Pinjore garden, for us the terraced gardens of the Kashmir were the most exciting. I suspect this was due to the refreshing climate in the Vale of Kashmir, the beautiful surrounding terrain and the charm of Lake Dal, rather than to the gardens themselves.

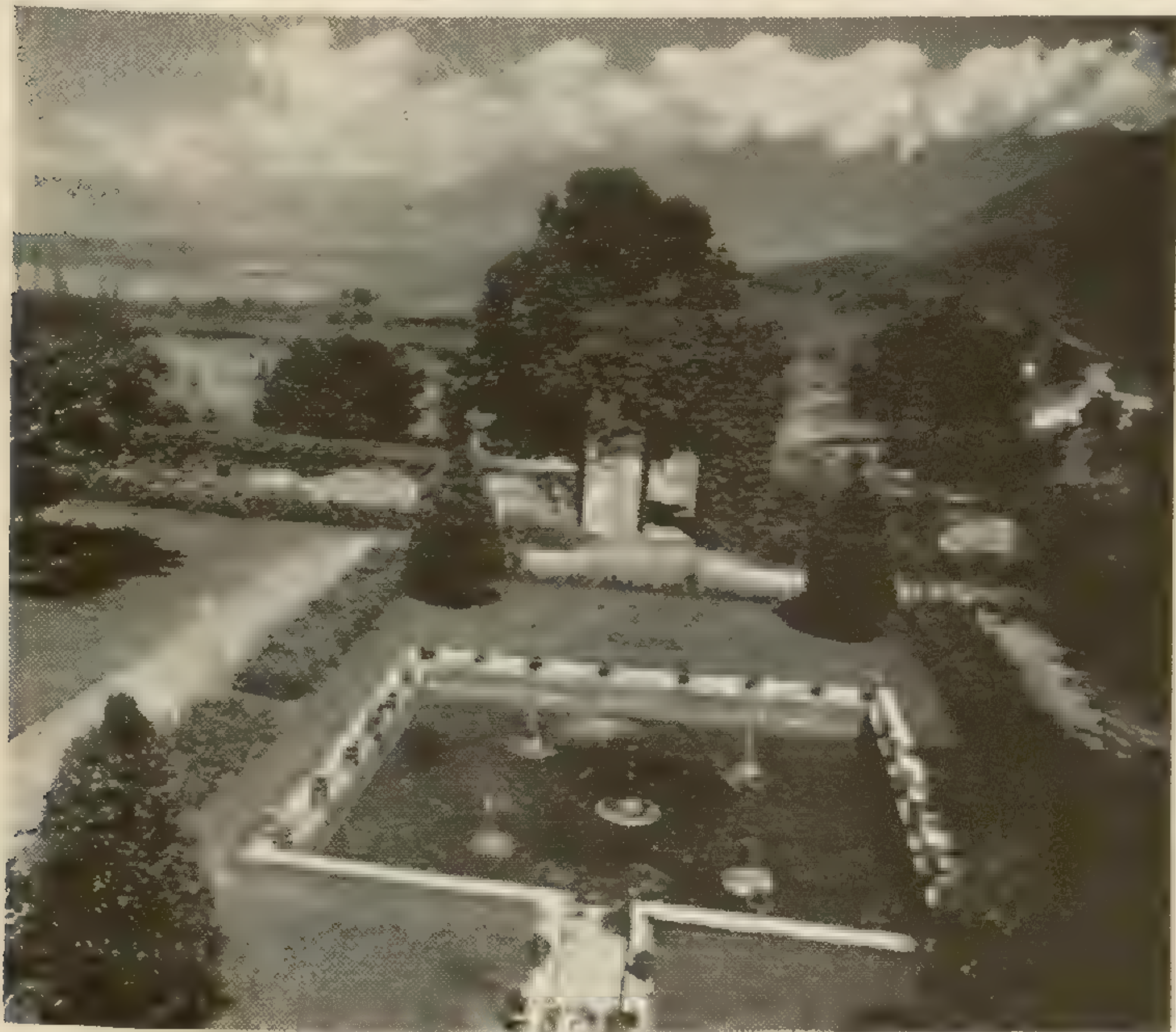
According to an old legend, about A.D. 100 the Emperor Pravarsena II built a villa near the northeastern portion of Lake Dal, the largest lake in the Kashmir, and about a mile inland from the open water. It was called "Shalimar" which in Sanskrit means "The Abode (or hall) of Love". In 1619 the Mughal Emperor Jahangir laid out a garden on the same old site as the old villa of Emperor Pravarsena. The margin of the lake was an area of marshy swamps, willow groves and rice fields. A 35-foot canal was dug through the shallow water to connect the garden with the deeper open water and the customary approach was by barge or 'shikara' (small gondola-type boats). On each side of the canal there were broad green paths overshadowed by the large chinar trees.

The Shalimar was a royal garden and has been maintained to the present time by His Highness, the Maharja of Kashmir. The enclosure is 590 yards long and about 267 yards broad, divided into the outer garden, the central or Emperor's garden, and, most beautiful of the three, the garden for the special use of the Empress and her ladies.

Now the broad canal leading from Lake Dal has disappeared and a public road has destroyed the public gardens. The grounds are reasonably well-maintained but the water courses lack water and have been planted to grass. The chinar trees are there, beautiful and large, and of course the vistas of the surrounding hills and distant snow-capped peaks will always be there to delight the eye.

One of the gayest of all Mughal gardens is Nishat Bagh, beautifully situated on Lake Dal, and having 12 terraces, one for each sign of the zodiac. Originally its approach was by water from the lake, but at the present time a road has cut off the lakeside terrace. Its building and watercourses (now dry) allow a visualization of the life and times of the Mughals and certainly should be included in a tour of the gardens of Dal Lake.

The garden that provided the best view of Dal Lake of any we visited is the "Garden of the Royal Spring". The "Chasma Shahi Bagh" shows that a Mughal garden need not necessarily be large to prove attractive. This little garden seemed a gem to us, due partly to its wonderful view over Lake Dal and partly to the tiny



Chasma Shahi Bagh overlooking Lake Dal in the Vale of Kashmir.

carved water shoots between the several terraces. In the center of the second terrace is a reservoir with five jets. Around its edges are the outlines of a continuous flower parterre and the sides of the garden are still filled with lilacs and fruit trees. The terraces are 18 to 20 feet high, one above the other. As usual, there were water curtains, water sheets, shoots, canals, and the other fountains and appurtenances that the Mughal garden designers so effectively developed, but most of these no longer function.

Although the original garden of the Shalimar was constructed on the shores of Lake Dal in the Vale of Kashmir, a second Shalimar garden was built in 1634 at Lahore on the plains of the Punjab. This garden lacked the beautiful surrounding terrain of the Kashmir, but the designers succeeded in creating a bit of Paradise, which is impressive considering the handicaps they were facing, in the center of an arid, flat, unattractive land. At present the Shalimar at Lahore is not well-maintained and may be disappointing to a visitor who has seen the garden pictured with national pride on the postage stamps of Pakistan.

A discussion of Mughal gardens would not be complete without recognizing the reverence with which the lotus flower is held by the Hindus. It is considered a sacred flower much as the rose is the first flower in the eyes of the Moslem poets.

The houseboat in which we lived on Lake Dal had a lotus garden some 75 to 100 feet wide on the lakeside of the houseboat. From our houseboat we could see the lotus buds opening with the sunrise, but it was even better to go out among them in our 'shikara' and enjoy the freshness of their large leaves in the morning sun. It is the belief of the Hindus that the sun wakens the lotus buds of Brahma. "Aum, Man padme hum" (Hail, Lord Creator! The jewel is in the Lotus.) is said to be the oldest and most sacred prayer in India.

Perhaps the most vital impression a visitor carries away from India is that elements of all ages and cultures in various stages of development are surviving there side by side today.

* * *

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Hindu temples and worshippers at sunrise on the banks of the Ganges River at Benares.

About Arboretum Peacocks *"Lucky" Baldwin's Birds*

(Reprinted from WESTWAYS, copyright 1964, Automobile Club of Southern California.)

CAROLINE S. G. MUNRO

On the lower slope of the foothills where the precipitous San Gabriel Mountains level off into the valley is a natural spring-fed lake. During the last century, the beauty of this little lake encouraged Hugo Reid, the first white man to own the surrounding ranch acres, and later, the famous Elias J. "Lucky" Baldwin, to build their houses on the lake shore. Just before the turn of the century, Baldwin imported from India a pair of peacocks (*Pavo cristatus*).

The woods, the brush and the long grass were just to their liking, as were the nuts, seeds, insects and lizards. Whatever predatory animals existed — possums, coyote, skunks or foxes — were not numerous enough to be a threat. At night the peacocks could roost as usual in the tall trees; their ability to achieve altitude in flight is astonishing considering their size. A treetop may not be the warmest place, but it is certainly much safer than the ground.

Only the peahen sleeps on the ground while hatching her eggs or brooding her chicks, and this is a perilous time. A crafty possum or other night prowler may steal her eggs or chicks, when the mother peahen drops into deep sleep. Quite often two or more peahens nest in close proximity; they later stroll about in friendly fashion, chicks intermingling. When the mothers separate, however, the chicks seem to know which one to follow and under whose tail to take shelter in case of danger.

The original pair of peacocks at the Baldwin Ranch soon became ancestors of a considerable flock. After Baldwin's fortune vanished, the property was almost completely neglected, but the peacocks maintained their way of life feeding in the brush and drinking from the lake. When some of them were in a wandering mood they flew over the fence and visited neighboring territory. At one time a sign on Colorado Blvd. outside the fence read: "Slow Down — Watch for Peacocks Crossing the Road."

In the late 1940's the Los Angeles State and County Arboretum was born and acquired approximately 125 acres of the Baldwin Ranch, including the beautiful little lake and some 200 peacocks. The days of neglect and seclusion were gone. Seed beds, greenhouses and roads were built and old buildings restored. Did these innovations disturb the peacocks? Not at all. They made their nests as usual in the

thick brush, slept in the high trees, and alone or in pairs wandered about with their usual grace and dignity. Only on rainy days is a peacock, drenched and bedraggled, lacking in glamour.

The new projects, in fact, were a matter of interest to the peacocks and one or two at a time they would stroll over to inspect progress. A parked car with a shiny bumper deserved careful attention. A peacock might spend the good part of an hour getting different angles on his own reflections.

The birds had a slight brush with the botanists because they ate the newly-sprouted plants in the experimental seed beds. Then someone discovered a solution. A single line of white twine suspended from sticks about 12 inches high was staked around baby plants. An electrified wire would not have been a greater deterrent. Why? No one knows but the peacocks.

On Sundays the public comes through the turnstiles by the hundreds and scatters out through the grounds. The peacocks continue to stroll about, keeping somewhat aloof, but watchful in case a human approaches one of the penny dispensers or shows other evidence of sharing food. Almost anything is acceptable, including banana skins, which are swallowed whole.

These fowl from the jungles of India became Californians. Like the multitude of humans inhabiting this state, they have travelled thousands of miles, accepted the new environment, maintained their habits of living, and adjusted to the changing surroundings.

* * * *

ON THE COVER: The Indian peafowl, (*Pavo cristatus*), which we mistakenly call "peacock"* is native in India from the foot of the Himalayas to Ceylon and from the Indus River in the west to the Brahmaputra River in the east. It lives in rather open country from sea level up to four thousand feet, but shuns the plains and deep forests, preferring park-like land with scattered trees or scrub, the river banks, forests clearings or any place with sufficient cover in which to nest. It was introduced into the eastern Mediterranean countries before the Christian Era, and the Pharaohs of Egypt and kings of Asia Minor received them from the Phoenicians. They were known to the ancient Greeks and Greek mythology tells us that the peacock was sacred to the Goddess Hera. She was so fond of them she adorned their tails with eyes — the eyes of her lover, Argus.

These glamorous birds with eyes in their tails were rare in Europe until Alexander the Great brought them from India. From Greece they spread to Rome and it was in Europe in the Middle Ages that the peacock was first brought to the table — served as a delicacy on great occasions, in spite of the fact that their meat was coarse and tough. They retained this distinction until the 15th century when the turkey of the New World made its first appearance as roasted fowl — and how fortunate, indeed, or we may have been obliged to serve peacock for our Thanksgiving Day feast.

*This gets us involved in such anomalies as "female peacock" instead of "peahen".

The Peepul, Bo, or Bodhi Tree

W. S. STEWART

On the return route to Bichpuri from our tour of Nepal, Darjeeling and Calcutta, we were fortunate to visit the famous Peepul tree (*Ficus religiosa*) growing at Buddhagaya, about 200 miles east of Varanasi (Benares).



The 'Bo', 'Peepul', or 'Bodhi' tree (*Ficus religiosa*) and shrine at Buddhagaya.

According to the language of the region of India, this tree has the following common names: Pipal (Hindu); Asvattha (Bengali); Drasi or Avasi (Tamil); Avasai or Arasu, Bodi or Bodhi (Malayalam); Ravi, Ragi, or Rai (Telegu); Bo (Sinhalese). [These synonyms emphasize the real value of the international system of Latin botanical names and point out an important aspect of the problem of communication in India.]

On viewing this venerable tree, I sought permission from the Superintendent to take a cutting for the Arboretum. The request was politely refused and in lieu of the cutting, several pieces of dead branches and some leaves from the sacred tree were given to us.

This specimen of the fig family is described by Cowen (1) as follows:

"For antiquity and veneration the Peepul is unrivalled throughout the world. No other tree is claimed to have such long life — part of one in Ceylon, said to have been planted in the year 288 B.C., still lives and flourishes. The Prince Siddhartha is known to have sat in meditation under a Bo tree and there found enlightenment from which time he became known as the Buddha. So, from then on the tree was sacred to Buddhists. Hindus associate the tree with the three gods Brahma, Vishnu and Shiva and worship it. They also relate the legend of the Hindu boy who died during his thread ceremony and became a ghost to haunt the tree for ever after. In such veneration is it held that it is forbidden for any devotee to fell it, harm it or utilize a part of it in any manner. Even if found growing in a dangerous position or to have sprouted in some unsuitable place, which it does very frequently, the task of removing it is given to some person of another religion. Thus, by shifting the responsibility to the shoulders of others, the faithful can witness the destruction of the sacred tree with equanimity!"

The Maha Bodhi Society of India in their guide to Buddhagaya (2) has this statement regarding the "Bodhi Tree":

"Sitting under the Bodhi Tree, Prince Siddhartha attained enlightenment and became the Buddha on the full moon day of the month of Vaisakha, and for seven weeks He kept on meditating on the bliss He had attained, spending one week at each of the seven places. The first week was passed under the Bodhi tree itself which was the central object of worship to the Buddhists at Buddhagaya. The present tree is situated to the west of the temple and is about 100 feet high. It is said that the original one under which the Lord attained Buddhahood sprang up on the day of His birth and stood there for centuries for the devotees to worship. Fa-Hien says, in his travels, that Emperor Asoka used to visit the Bodhi tree "habitually" to repent himself of his sins, to chastise himself and subject himself to the eight purifications. The king's wife asked whether the king daily repaired to the promenade(?). The grandees replied that he always went to the tree Peito. The queen awaited the time when the king was not there, and sent people to cut and throw down the tree. When the king returned and beheld this, he was so troubled and afflicted that he fell to the earth. The nobles bathed his face with water, and after a long time he returned to his sense. He caused a brick wall to be built round the roots of the tree, and then to be watered with a hundred pitchers of cow's milk. He cast himself upon the ground, and made an oath never to rise again unless the tree were reproduced. Scarcely had he made this oath than the tree began to sprout again from its roots, and from that time to the present it has become at least ten chang high.

"According to history, Sasanka, a Hindu King of Bengal, had the Bodhi tree cut down and destroyed but luckily another tree arose out of the same roots. When Cunningham started the repair work of the temple in 1870, the old tree fell down, so he had a sapling from it planted at the very spot for the exclusive worship of the Buddhists. At a distance of about 250 feet to the north of the temple, another tree was also planted for the use of the Hindus who come here to offer pinda in memory of their ancestors. Asoka is said to have enclosed the Bodhi tree with a stone railing of excellent workmanship. He also made a pilgrimage to the tree with a great retinue, the scene of which is illustrated on one of the Sanchi gateways. This scene shows a pillar by the side of the tree but no trace of it has been found up to now. Can it be the pillar recently brought from the Gaya town and set up at the entrance to the lake? Emperor Asoka's daughter Sanghamitta conveyed a branch of the original tree to Ceylon and planted it in the sacred city of Anuradhapura where it is in excellent preservation even today after 2,000 years of continued existence, nourished by the pious Buddhists of the Island. It is thus the oldest historical tree in the world."

You will be pleased to know that there are several fine specimens of the Bodhi tree in Southern California including one at the Arboretum. Looking at this specimen now brings back wonderful memories of our all too brief visit at Buddhagaya.

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An Orchid for the First Lady

PRAMILA PANDIT BAROOAH

No queen received greater public acclaim nor won the hearts and affections of so many people in so short a time as did America's First Lady on her trip to India. Mrs. John F. Kennedy, better known as "Jacqueline" by her adoring public, received tremendous news coverage on her visit with Prime Minister Nehru, on her trips to the Taj Mahal at Agra and to the Amber Palace at Jaipur, on her visits to the hospitals and welfare centers, and even on her shopping tours for sarees in the famous bazaars of Benares.

As is often true, the seldom-told, "behind-the-scene" stories are far more interesting. Such is the story I am about to tell.

It happened in Assam, a rather isolated State in the most eastern part of India, practically cut off from the rest of the country by East Pakistan. Assam is semi-tropical and has a rather wide variation in climate and rainfall. Trees of all types bloom in a riot of color. Wild orchids of many types and colors grow in profusion. Picking an orchid from a tree along a golf course in Assam would be no more unusual than picking an orange along the "Howie-in-the-Hill" golf course in Florida. But all plants in their natural habitat tend to follow seasonal patterns of flowering. The orchid is no exception, and because of this, we have a story to tell.

Located in the Khashi Hills, at an elevation of about 5,000 feet, is Shillong, capital of the state. Government officials and tea planters flock into these hills in the summer to escape the oppressive heat and high humidity of the valley. The only route to Shillong is from Gauhati, the largest city in Assam, over a 60-mile winding, hilly, one-way road. Car traffic is regulated by a series of gates at 15-mile intervals. At these points the traffic passes one way at a time. If one is fortunate enough to arrive at the starting gates at the proper times, the journey requires about three hours. However, there is no way to accurately predict when or how long the gates will be open. I mention this because it concerns a later part of my story.

It all began with the ringing of the telephone in our home at Shillong. My husband, the Director of Agriculture of the State of Assam, answered it suddenly and stood at attention, and clicked feet together.

"What is it?" I asked.

With a broad smile, he said, "Orchids—orchids for the First Lady of America."

The Prime Minister of India had requested the Governor of Assam to send to New Delhi, by air, the most beautiful orchids that could be found in all of India for his guest, Mrs. Jacqueline Kennedy. This caused quite a hub-bub in the family. We must have orchids on the plane leaving from the airport at Gauhati the next afternoon. Even though Assam is noted for its orchids, this request had come at a most inopportune time. This was March. Shillong had just gone through two cool, wet weeks and orchids in this area are not usually in bloom until April or May. Assam has no greenhouses and relies on Nature's benevolence to produce the blossoms at her leisure.

It was too late to locate any orchids that day, but we immediately set to work

to marshal our forces for an all-out effort to begin the next morning. Two government men, four gardeners, four plant inspectors and two policemen were recruited and each assigned a place to search for the perfect orchid.

The next morning, with hardly a bite of breakfast, and as the sun was just peeping over the eastern hills, my husband, the children and I set out. We saw over 8,000 orchids plants with scarcely a bloom. It had been just too cool. We were all but in despair when an inspector returned from the Cherripunji "rain valley" with some small golden orchids. We picked each blossom with care and fashioned a tiny bouquet. This was better than nothing, but we were far from pleased. Was this the best we could do?

Our other scouts returned from other hills and valleys with little or nothing to show. It was then that someone suggested that a gardener on the Upper Shillong Road, Mr. G. P. Gee, made wild orchids his hobby, and it was just possible he might have some in bloom.

The Governor turned over to us his car and uniformed chauffer and off we went through the hills. Our hearts were heavy and Nature seemed to be poking fun at us. It was a beautiful day and all along the way we saw peach, pear and plum trees in full bloom as if flaunting their colors at our despair. Time was running out. A feeling of anxiety and urgency gripped us. This was it — our last chance. It was almost twelve noon. The last gate for the down hill, one-way traffic to Gauhati was at one o'clock. With good luck we might just make it — but first we must find the orchid.

Thus we arrived at the residence of Mr. Gee and told him of our plight. He only smiled and led us into his gardens. It was difficult for us to believe our eyes! Many rare and exquisite orchids were in bloom, of all sizes and colors. It would be a problem to pick and choose. Mr. Gee explained that he had selected this location long ago for raising orchids, as he had noted that the unusual air currents permitted early bloom. He readily gave his consent to our request for one of his finest blooms, considering it an honor to supply an orchid for so distinguished a personality. We finally picked out three spikes of *Cymbidium*, each spike having twelve to fifteen flowers, each a glorious galaxie of purple, white and gold.

Hastily we packed the fragile flowers in moss and cellophane. Our joy in finding the orchids was all but lost in our anxiety to deliver them to the plane. We made the first gate on time; each gate thereafter seemed to be agonizingly slow. Out of the hills at last, and down in the valley and to Gauhati. The narrow streets were jammed with people, cattle, ox-carts, cars and trucks. Had it been a "puja" or holiday celebration we would never have made it through Gauhati. Another 11 miles to the airport!

Alas! Just as we arrived, we saw the plane taking off!

Out of the car — up to the dispatcher. "You must bring the plane back!" we cried. Only after he saw the box consigned to the Prime Minister did he consent to do so. Immediately the plane returned and the precious package was placed aboard.

Six hundred miles to Calcutta, then another 900 miles to Delhi flew the orchids for the First Lady. The small, fragile-appearing blossoms must arrive fresh and bright, for they would be the emissary from Assam to greet her and bid her welcome. They would also speak of the hospitality of India and the wish that Jacqueline would someday return again.



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ARBORETA AND BOTANIC GARDENS

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